Acid News

NO. 3, OCTOBER 2009

Bring them in!

Greenhouse gas emissions from international shipping and aviation clearly must be regulated. Bringing them into a revised Kyoto Protocol is a first step.

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Island states call for action

Island states and least developed countries agree: Rich nations have caused the problem, and should cut greenhouse gas emissions 95 per cent by 2050.

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Air quality exemptions questioned

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High noon for +2°C

A new AirClim factsheet takes a close look at the +2°C target for global warming. What are the allowed emissions if it is to be met, and how should the burdens be shared?

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Cleaner ship fuels may save 45,000 lives

Lowering the sulphur content of fuel used in shipping could prevent upwards of 45,000 premature deaths a year by reducing exposure to fine particles, a new report claims.

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Pollution legislation watered down

EU environment ministers have agreed to weaken proposals for stronger industrial pollution control.

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Most rich Kyoto countries off track

Many rich countries will not be able to meet their climate commitments through active policy initiatives. Only "hot air" will do the trick.

Many countries that have made commitments under the Kyoto agreement will have problems meeting them. For most countries this will only be possible by resorting to "hot air", such as pointing to falls in emissions that occurred in the ex-communist world after the fall of the Berlin wall, or largely unplanned changes in land use, or the CDM. The EU15 may be able to meet its commitments solely by means of measures taken at home.

The UN Climate Convention has summarised the changes in emissions that have taken place between 1990 and 2006 *(see table 1, p. 3)*. The results hardly make encouraging reading. Emissions in the former communist countries (except for Slovenia) have fallen by 30–50 per cent, although this is clearly not due to active climate policy initiatives. The EU has

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

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

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

In furtherance of these aims, the Secretariat:

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

AirClim

Editorial

In June 2009, a coalition of environmental organisations presented a benchmark Copenhagen climate treaty. The document describes the path the world must be on to avoid catastrophic climate change, recognising that global temperature increase must be kept well below 2 degrees Celsius *(see article on page 8)*.

Achieving this requires setting a global cap on emissions – a carbon budget. In 2020 the cap should be no higher than 36.1 gigatons carbon dioxide (Gt CO_2) equivalents, i.e. roughly equal to 1990 levels. By 2050 the cap need to be lowered to 7.2 Gt CO_2-equivalents, which implies cutting total greenhouse gas (GHG) emissions by at least 80 per cent.

ERIC GEVAERT - TENTACLE/FOTOLIA

Industrialised countries, as a group, should commit to an emissions pathway that includes GHG emission reduction targets of at least 40 per cent by 2020 and at least 95 per cent by 2050, compared to 1990 emission levels.

The benchmark treaty also calls on rich nations to provide at least US$160 billion per year from 2013 through 2017 to help poor countries to cut their own emissions and adapt to the warming already underway.

In spite of the fact that GHG emissions from international transport – shipping and aviation – are big and rapidly growing, both sectors have so far remained totally unregulated.

Responsibility for (not) reducing these emissions lies with the International Civil Aviation Organisation (ICAO) and International Maritime Organisation (IMO), both United Nations agencies. Both institutions have spent more than a decade on discussions and studies, but neither has agreed one single binding measure to control emissions.

The most recent greenhouse gas study by the IMO, from April 2009, identified a significant potential for GHG reduction from shipping through technical and operational measures *(see AN 2/09, p. 8)*. Together, if implemented, these measures could increase efficiency and reduce the emissions rate by 25-75 per cent below the current levels. Moreover, it demonstrated that reductions of at least 20 per cent could be achieved by 2020, without expense to the industry.

According to the same study, shipping activity could double or even triple by 2050. Under a business-as-usual scenario, this would mean that emissions from global shipping will reach between 2.7 and 3.6 Gt CO_2 by 2050, which equals 38-50 per cent of the allowable global carbon budget for that year.

Emissions from international bunkers used by shipping and aviation clearly must be regulated. Bringing them into a revised Kyoto Protocol is a first step. Initially, bunker emissions should be reduced by at least 40 per by 2020, and at least 80 per cent by 2050, below 1990 levels.

Aviation and shipping could be given access to the global carbon markets, but the right to buy permits from outside the sector would be conditional on a given quantity of reductions having been achieved within the sector.

Revenues from the use of market-based instruments (be it a bunker levy or an emissions-trading scheme) should be allocated to an international fund and be used exclusively for adaptation and climate change needs in developing countries.

Christer Ågren

Rich Kyoto countries off track

Continued from front page

achieved a small reduction of 2.2 per cent, while the total for the remaining Annex I countries (not counting the USA) is an increase of 13.8 per cent, with Australia, Canada and New Zealand showing an increase of more than 20 per cent.

The good news is that it is very likely that the Kyoto requirements can be met – if the former communist countries sell enough of their surplus.

The EU15 consists of those countries that were part of the union in 1997 and are signatories to the Kyoto Protocol.

The Annex I countries also include Turkey, which is a member of the OECD, but has still avoided any quantitative commitment. They also include the USA, which has signed but not ratified the Kyoto Protocol. Emissions by these two countries have risen by 95 per cent and 14 per cent respectively.

If the USA had ratified Kyoto and committed to a reduction of seven per cent, but increased emissions as it has done, this would have meant a shortfall of 1,313 million tonnes (Mton) of carbon dioxide equivalents (CO_2eq.) Even this could have been covered by the large surplus from Russia, the Ukraine and other states.

At the time the Kyoto agreement was originally negotiated there were some murmurings of a recovery by heavy industry in the east following the slump. We now know that this was a lasting change in infrastructure. Whether intentional or not, the collective Kyoto undertaking effectively became little more than a redistribution of capital for emission reductions that had already been achieved.

The EU, which was the driving force behind the initial drafting of the Kyoto agreement and subsequently rescuing it after the USA's withdrawal in 2001, has little to boast about either.

Breakdowns of figures are also available for the EU for 2007.

The EU's reduction can partly be explained by the collapse of East German industry following reunification in 1990, which contributed to a fall in emissions of around 120 Mton in the early years of the 1990s, i.e. more than the entire reduction by the EU.

Other free reductions were achieved through reductions in agriculture, which led in turn to lower emissions of carbon dioxide, methane and nitrous oxide. Coal output was reduced purely for economic reasons, and on economic grounds alone would have been reduced even further if it were not for subsidies. Some older coal-fired power plants and steelworks were also closed for economic reasons.

Another factor was a reduction in methane emissions from landfill sites, a development that is only partly accountable to climate policy, but which is naturally welcome for the environment, energy conservation and fire safety. By 2007 emissions had almost halved, from 128 Mton CO_2eq.

The two central items in the emissions budget, transport and power generation, both saw increases on the other hand. CO_2 emissions from the power sector in the EU15 rose from 949 Mton in 1990 to 1,029 Mton in 2007. Greenhouse gas emissions from transport rose from 662 Mton in 1990 to 826 Mton in 2007.

The picture that thus emerges is that emissions in key sectors continued to rise in all the rich Annex I countries until 2006 or 2007, while those in the more peripheral sectors fell, mainly for reasons unrelated to climate policy.

The idea that China and India pose the big threat to the climate is true in some respects, but false in others. Emissions from India and China in particular are very high in absolute figures, and have risen very sharply *(see table 2)*. However, when emissions from India and China are added together (roughly calculated at 10,400 Mton) they are still less than those from the rich Annex I countries, in other

Contd on following page ▶

	Mton CO_2eq		Commitment, %	2006, % of base year
	1990	2006		
Australia	416	536	8	28.8
Belarus	127	81	-8	-36.4
Bulgaria	133	71	-8	-46.2
Canada	592	721	-6	21.7
Croatia	33	31	-5	-5.2
Czech Rep	194	148	-8	-23.7
Estonia	42	19	-8	-54.6
EU-15	4,244	4,151	-8	-2.2
Hungary	116	79	-6	-32.1
Iceland	3	4	10	24.2
Japan	1,273	1,340	-6	5.3
Latvia	26	12	-8	-56.1
Lithuania	49	23	-8	-53
New Zealand	62	78	0	25.7
Norway	50	54	1	7.7
Poland	563	400	-6	-28.9
Romania	282	157	-8	-44.4
Russia	3,326	2,190	0	-34.2
Slovakia	74	49	-8	-33.6
Slovenia	20	21	-8	1.2
Switzerland	53	53	-8	0.8
Ukraine	922	443	0	-51.9
TOTAL	**12,600**	**10,661**		**-15.4**

Table 1. Change in greenhouse gas emissions 1990–2006 in Annex I countries. The figures are not totally accurate. Firstly they do not take account of changes in land use. Secondly, all the figures are being readjusted continuously, including those for the base year. The base year is largely the same as emissions in 1990, although there may be some small deviations. **Source:** *http://unfccc.int/resource/docs/2008/sbi/eng/12.pdf*)

A small dictionary of climate politics

CDM, the Clean Development Mechanism, is an option provided by the Kyoto Protocol for Annex I countries to buy emission rights through projects in (poor) countries that have not made any undertaking.

GHG: The GreenHouse Gases are a basket of six gases with global warming potentials that are recalculated as carbon dioxide equivalent. In addition to carbon dioxide they consist of: methane, nitrous oxide and three industrial fluorinated hydrocarbons.

Annex I countries: those countries that have agreed commitments under the Kyoto Protocol.

words the EU15, USA, Japan, Canada, Australia and some smaller countries, which emitted around 14,000 Mton for a smaller population.

The "problem" therefore lies both with the rich nations and the rapidly developing economies. It also lies with other developing countries that have not been counted here, and despite the reductions made, also with eastern European economies.

Any fair attribution of the problem must also consider emissions per capita. Total greenhouse gas emissions are not available for non-Annex I countries, but there is data for CO_2 emissions. Figure 1 shows per capita emissions for a selection of countries. The countries that have the lowest emissions are, apart from Afghanistan, poor and often war-torn African nations: Eritrea, Mozambique, Congo (formerly Zaire) etc, all of which have emissions of 0.1 ton per person or less. Some of these countries have a large population, but their contribution to the climate problem is nevertheless almost negligible.

The five highest emitters are all oil nations, as are several others near the top of the table.

	CO_2 emissions (Mt)			GHG emissons (Mt)		2006/1990 % for CO_2
	1990	1994	2006	1994	2006 (estimate)	
China	2417.1	3002.4	6109.1	4058	8300	153
India	691.1	865.8	1511.7	1214	2100	119
Mexico	385	408.5	436.7	473	500	13
Brazil	209.2	242.2	352.7	663	1000	69
South Africa	334	359.3	415.8	380	440	24.5

Table 2. Emissions of greenhouse gases by selected emerging economies.
Sources: CO_2 from 1990, 1994 and 2006 from *cdiac.ornl.gov/trends/emis/meth_reg.html*, (recalculated from C to CO_2). 1994 GHG from *unfccc.int/ghg_data/ghg_data_unfccc/ghg_profiles/items/4626.php*, estimate under the assumption that the GHG/CO_2 relation is the same as in 1994.

There is broad correlation between the prosperity of a nation and the size of its emissions, but the link is not clear-cut. South Africa is not richer than Switzerland, but it has higher per capita emissions. Estonia is not richer than Sweden, but has carbon dioxide emissions that are twice as high.

Most striking, however, are the high emission figures for the USA, Canada and Australia – around ten times as high as countries such as India and Indonesia.

China is by far the largest country in the world by population, and also comes top for carbon dioxide emissions. On a per capita basis, emissions are on a par with Switzerland or Sweden. By comparison, per capita emissions from the USA are four times higher. China has also stated that a significant share of its growing emissions are "implicit", since it exports products with a high carbon footprint to other countries, rather than consuming them domestically. These implicit emissions will not be quantified here, but clearly also have implications for the USA.

Summaries that cover the period to 2006 or 2007 do not however say much about the future, and may not even give a clear picture of the situation today. A number of climate policy decisions have been or soon will be agreed, and new climate targets have been adopted in many countries. In 2007 the EU was still in the trial period for emissions trading, and an over-generous allocation of emissions then led to a market collapse. Despite a very serious economic crisis this situation has not been repeated.

The combination of more restrictive allocations, a recession and many different national measures means that the EU may be able to meet its commitments for the entire period 2008–2012 at the domestic level.

An estimate by the European Environment Agency[1] suggests that emissions by the EU15 in 2008 could reach a total of minus 6.2 per cent. There is obviously no data for 2009, but it is clear that reductions will continue into this year.

As can be seen in figure 2, there are big differences in performance between the EU countries. The differences remain, even after burden sharing is taken into account. While Belgium, France, Ger-

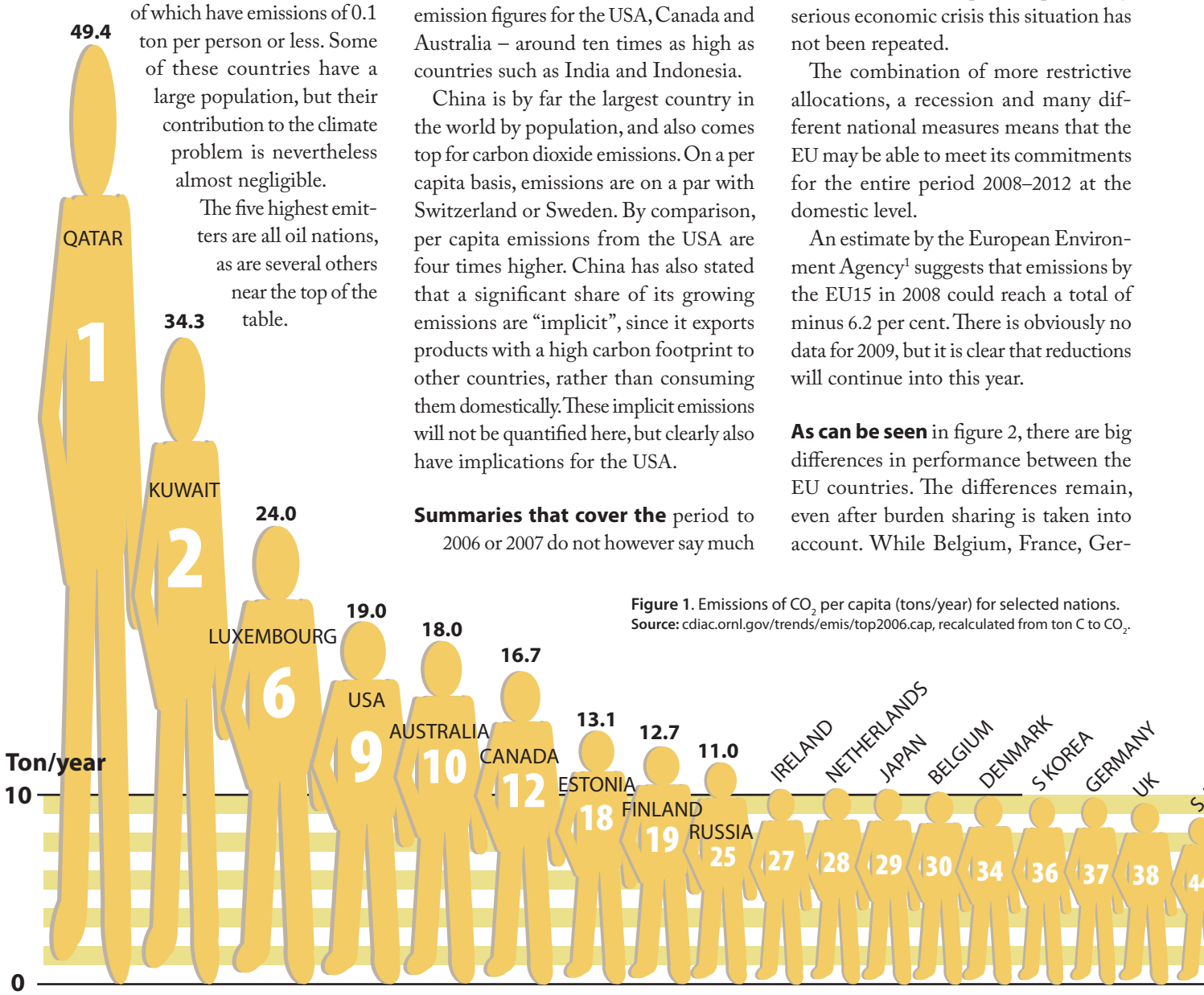


Figure 1. Emissions of CO_2 per capita (tons/year) for selected nations.
Source: cdiac.ornl.gov/trends/emis/top2006.cap, recalculated from ton C to CO_2.

many, Greece, Sweden and the UK all had lower emissions in 2007 than they undertook to meet by 2008–2012, the majority of countries were far from their targets. The worst was Spain, which was almost 40 per cent too high, and Austria at almost 30 per cent too high. The best was Sweden, with emissions that were over 13 per cent lower than allocated under burden sharing.

The gap between the best and worst countries can to some extent be ascribed to unpredictable developments, such as the German reunification, ageing power generation plants in the UK, which sparked the country's "dash for gas", and an unreasonably low burden allocation for Sweden. However, there is no doubt that some of the difference is also due to stronger (or earlier) implementation of climate policy in the better countries compared with the others.

The difference becomes even more striking when comparing the USA, Australia and Canada with the EU15, or with Germany and the UK. The wide gap in emissions that existed in 1990 not only remains but has grown rapidly. Although European climate policy can be accused of being weak, late in coming and inconsistent, it has nevertheless led to declining emissions. In the USA, Australia and Canada, coal and oil interests have been able to steer policy until very recently.

Despite the big changes that are now taking place in all these countries, as well as Japan, many years have been lost since the UN first drew serious attention to the climate issue in 1987.

Fortunately these years have not been entirely wasted. Some of these countries, including some of the worst performers, have taken steps that do not show in emission statistics, but are still significant. This is true of Denmark, which for a number of years was responsible for a large share of

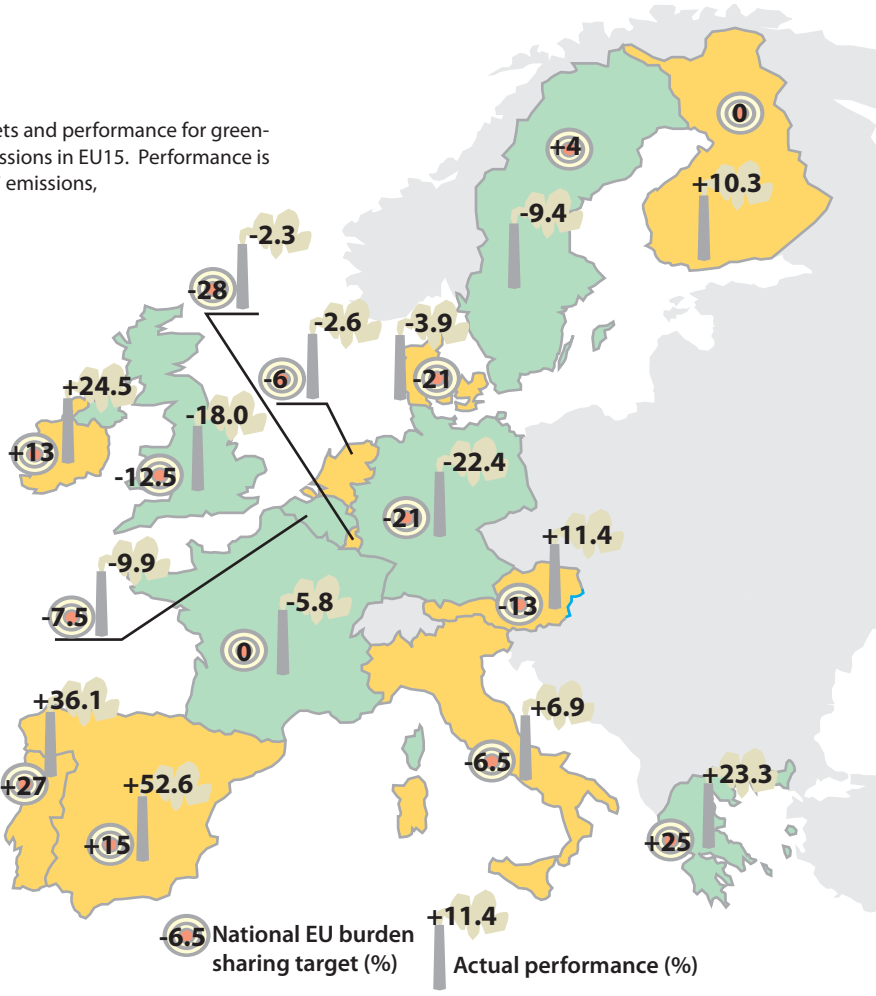


Figure 2. Targets and performance for greenhouse gas emissions in EU15. Performance is based on 2007 emissions,

global investment in wind power, until the baton was passed first to Germany, then Spain, the USA and a long list of other countries. Wind power is now not only a theoretical alternative but also accounts for a significant proportion of new power generation around the world. Solar water heating is an important energy source in China and is now being exported on a large scale.

Photovoltaic solar electricity still lags a number of years behind wind power, but is also on the way to becoming an important energy source. Japan was the leading manufacturer for many years, but China is now establishing its place. For a number of years the main market was in Germany, but Spain has now taken over and in 2008 accounted for almost half the new capacity in the world[2] in a year when the global market for solar panels more than doubled in size. Spain's leading role in renewables is largely due to a shift in policy following a change of government in 2003.

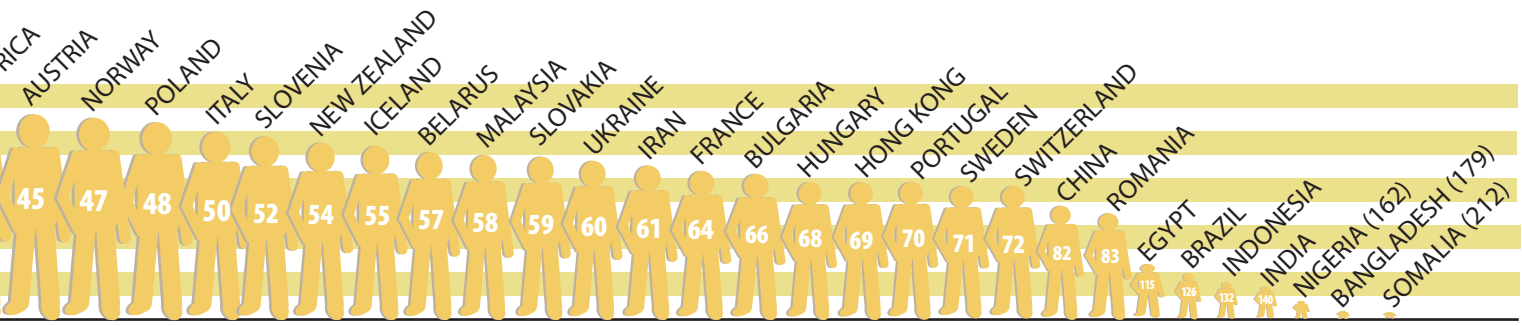
The growth and availability of fossil-free alternatives for producing electricity and hot water in multi-gigawatt capacities is largely due to climate-related political initiatives.

Politics plays a role. Even a relatively small country can sometimes change the global playing field when it comes to climate policy.

Fredrik Lundberg

1) www.eea.europa.eu/highlights/new-estimates-confirm-the-declining-trend-in-eu-greenhouse-gas-emissions

2) www.epia.org/press-releases.html March 24, 2009.



Island states demand 95 per cent emission cuts

Island states and least developed countries agree: Rich nations have caused the problem, and should cut emissions 95 per cent by 2050.

The rich countries need to cut greenhouse gas emissions 95 per cent by 2050, 40 per cent by 2020.

So says the Alliance Of Small Island States (AOSIS), which recently joined forces with the Group Of Least Developed Countries (G-LDCs) in demands for further commitment under the Climate Convention and Kyoto Protocol.

In a press statement on August 14 [1], the joint group of 80 nations, with a population of about 800 million people[2] asked for

- a return to 350 ppm of CO_2
- a maximum temperature increase of as far below 1.5 degrees as possible.
- that global emissions peak by 2015 and are reduced by at least 85 per cent below 1990 levels by 2050.
- that rich nations (Annex I) must reduce their emission 40 per cent by 2020.

ANDREW DORAN/FOTOLIA

Waiting for some action...

According to the AOSIS-LDC, the pledges from Annex I countries amount to no more than 10–16 per cent reduction from 1990 to 2020. (After the Japanese election this figure has improved somewhat.)

This would, according to AOSIS-LDC "risk taking us on a path to temperature increase in excess of 3 degrees of pre-industrial levels. Such a level would be catastrophic for all countries."

"Recent studies show that the cost for developed nations of achieving a 40 per cent reduction is as low as 0.5 to 1.5 per cent of GDP by 2020. This is a small price to pay when compared to the anticipated skyrocketing costs for developing countries to adapt to a warmer world," said Dessima Williams, UN representative for Grenada and chair of AOSIS, in the press statement.

Bruno Sekholi, from Lesotho and chair of the LDC group added:

"We will not allow negotiators and governments to ignore the human cost of climate change: hunger, disease, poverty and lost livelihoods are all on our doorstep. These impacts have the potential to threaten social and political stability, and in some cases the very survival of low-lying island states."

Two other documents from AOSIS in March [1], presented by Grenada and Tuvalu for the Climate Convention, elaborate on the issue of attribution, and point to the fact that rich countries have a much greater historical responsibility. The CO_2 build-up in the atmosphere originates primarily from them.

All nations have a responsibility for where we are, but some more, very much more than others.

The documents refer to data for accumulated CO_2 from combustion (1850–2005) and deforestation (1950–2000), with striking results.

Of all human CO_2 so far, the United States has contributed 29.25 per cent or 328,264 megatons, whereas Annex I parties to the climate convention, including the United States, have contributed about 75 per cent of the accumulated emissions 1850–2005, and the developing nations only 25 per cent.

A closer look at the table shows even more disparity. The bottom half of the table (93 nations) have contributed 7.8 gigatons or 0.7 per cent of the emissions. These include nations with large populations, for example the two Congos.

Luxemburg, with a population of a half million, has emitted more CO_2 in absolute terms than Bangladesh, with a population of 153 million.

It should also be noted that there are some wealthy nations in the non-Annex I group: South Korea, Singapore, Brunei, Quatar, Kuwait and Israel are all high-emitters and have a large GDP per capita. On the other hand, some of the Annex I nations are far from rich.

The discrepancy between emissions from Annex I and non-Annex I, though large, is actually a blurred version of the very crisp rich-poor divide. This contrast between emissions from the rich and the poor obviously deepens much further if differences between income groups within

nations are accounted for, though that does not show in the UN data.

If the rich are the cause of global warming, the effects are disproportionate in the other direction. The AOSIS-LDC refers to a report from May 2009 by the Global Humanitarian Forum[3] led by Kofi Annan. It found that climate change already delivers global economic losses of US$125 billion per year, "with 90 per cent of the burden falling to developing countries."

The impacts enumerated by AOSIS-LDC hit the poor nations worst, but by no means exclusively: "sea level rise, ocean acidification, coral bleaching, flooding, drought, desertification, loss of fresh water supplies, biodiversity loss and more frequent and intense weather events including hurricanes".

The conclusion is that the Annex I parties collectively must reduce their emissions by more than 95 per cent from their 1990 levels by 2050.

The scientific basis for this is taken from IPCC. A stabilization concentration range of 445–490 ppm CO_2 equivalents (approximately equal to 350–400 ppm CO_2) is associated with a temperature increase of 2.0–2.4 degrees.

This is much too high, according to AOSIS. Even two degrees "would be devastating to the SIDS (small island developing states) and jeopardize the sovereign existence of many small island state parties to the (Climate) Convention and (Kyoto) Protocol".

AOSIS also points to the fact that recent scientific studies indicate that more ambitious and urgent action is necessary, for example:

- On top of a 0.4–1.2 m sea level rise due to thermal expansion alone, there is a risk of "substantial and possibly rapid loss of ice from Greenland and Antarctica". Loss of Greenland ice sheet would raise sea levels by 2–7 metres over centuries to millennia, and a global warming of 1.9–4.6 degrees could trigger this loss.
- Sea levels are rising faster than IPCC projected.
- West Antarctic ice sheet loss is accelerating.
- Arctic sea loss is outpacing IPCC projections.
- Greenland ice sheet rate of loss has accelerated in recent years beyond predictions.
- Since IPCC's fourth assessment in 2007, many studies have found that climate change is happening more rapidly and impacting key natural systems more severely and earlier than projected.

AOSIS also calls for a more transparent and understandable mitigation effort: taking 1990 as the base year for everybody and everything, to "ensure that there is no reward for failure to meet earlier agreed Kyoto targets".

The AOSIS documents mention the need for more money, "higher targets on both the mitigation and adaptation and finance fronts". But the emphasis is overwhelmingly on the moral obligation of the rich countries to clean up their own act. Ambassador Williams:

"The window of opportunity is closing quickly. Copenhagen is the last chance to avoid a human tragedy."

Fredrik Lundberg

1) *unfccc.int/resource/docs/2009/awg7/eng/misc01a01.pdf*

2) *www.unohrlls.org/UserFiles/File/Publications/Factsheet.pdf*

3) *ghfgeneva.org/Portals/0/pdfs/human_impact_report.pdf*

The top 20

	Country	Accum. CO_2 (Mt)	% of world total
1	USA	328,264	29.25
2	EU27	301,940	26.91
3	China	92,950	8.28
4	Russia	90,327	8.05
5	Germany	79,033	7.04
6	UK	67,777	6.04
7	Japan	42,742	3.81
8	France	32,032	2.85
9	India	26,008	2.32
10	Canada	24,562	2.19
11	Ukraine	24,016	2.14
12	Poland	22,330	1.99
13	Italy	18,409	1.64
14	S. Africa	12,444	1.11
15	Australia	12,251	1.09
16	Mexico	11,320	1.01
17	Belgium	10,702	0.95
18	Spain	10,389	0.93
19	Czech Rep.	10,130	0.90
20	Kazakhstan	9,939	0.89

The bottom 20

	Country	Accum. CO_2 (Mt)	% of world total
167	Chad	6.6	0.00
168	Burundi	6.4	0.00
169	Bhutan	5.7	0.00
170	Solomon Islands	5	0.00
171	Cape Verde	4.9	0.00
172	Nauru	4.7	0.00
173	Grenada	4.5	0.00
174	Lesotho	4.2	0.00
175	Samoa	4.1	0.00
176	S:t Vincent & Grenadines	3.4	0.00
177	Vanuatu	2.8	0.00
178	Tonga	2.7	0.00
179	Dominica	2.3	0.00
180	Sao Tome & Principe	2.2	0.00
181	Saint Kitts & Nevis	2.2	0.00
182	Comoros	2.1	0.00
183	Palau	1.6	0.00
184	Kiribati	1.1	0.00
185	Cook Islands	1	0.00
186	Niue	0.1	0.00

Table. Accumulated carbon dixode emissions (megatonnes) by country from fossil fuels 1850–2005 and from land use change 1950–2000. Global top 20 (left) and bottom 20 (right) nations. Yellow marked rows are Kyoto Annex 1 countries. **Source:** *cait.wri.org/cait.php?page=cumul&mode=view*

NGOs write benchmark Copenhagen climate treaty

Climate change experts from leading non-governmental environmental organisations have jointly produced their own blueprint for a legally binding Copenhagen agreement.

According to the authors, the 160-page "Copenhagen Climate Treaty" contains a full legal text covering all the main elements needed to provide the world with a fair and ambitious agreement that keeps climate change impacts below the unacceptable risk levels identified by most scientists.

The document describes the path the world must take to avoid catastrophic climate change, recognising that global temperature increase must be kept well below 2 degrees Celsius. It sets a global cap on emissions – a carbon budget – and explains in detail how both industrialised and developing countries can contribute to the safety of the planet and its people, according to their means and responsibilities, as well as showing how the poorest and most vulnerable on the planet can be protected and compensated.

For more information and to download the report, see: *panda.org/what_we_do/footprint/climate_carbon_energy/climate_deal/?166141*

Renewables overtake fossil fuel investment

Last year for the first time green energy overtook fossil fuels in attracting investment for power generation, according to figures released in June by the United Nations Environment Programme (UNEP).

Wind, solar and other clean technologies (not including large hydro) attracted US$140 billion compared with US$110 billion for fossil-fuel-based (gas, coal and oil) electrical power generation. This means that renewables currently account for the majority of investment and over 40 per cent of actual power generation capacity additions last year.

Information: *www.unep.org/Documents.Multilingual/Default.asp?DocumentID=589&ArticleID=6201&1en&t=long*

US to cut CO_2 from cars and light-duty trucks

A proposal to reduce greenhouse gas emissions from road vehicles in the USA will apply for model years from 2012.

The United States Environmental Protection Agency (EPA) and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) presented in September a joint proposal to reduce greenhouse gas emissions and improve fuel economy in road vehicles.

The standards proposed would apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012 through 2016. They require these vehicles to meet an estimated combined average emissions level of 250 grams of carbon dioxide (CO_2) per mile (g/mi) in model year 2016, equivalent to 35.5 miles per gallon (mpg) if the automotive industry were to meet this CO_2 level all through fuel economy improvements.

These proposed rules were developed in response to President Obama's call for a strong and coordinated federal greenhouse gas and fuel economy program for passenger cars, light-duty trucks, and medium-duty passenger vehicles *(see AN 2/09, p. 21)*.

EPA proposes to introduce emissions standards for CO_2 based on footprint curves, where each vehicle has a different CO_2 emissions compliance target depending on its footprint value (related to the size of the vehicle). Generally, the larger the vehicle footprint, the higher the corresponding vehicle CO_2 emissions target.

The table shows the projected fleet-wide CO_2 emission level requirements for cars and light trucks under the footprint-based approach. These requirements are projected to increase in stringency from 261 to 224 g/mi for cars, and from 352 to 302 g/mi for light trucks, between model year 2012 and model year 2016. The average vehicle CO_2 emissions compliance level for the model year 2016 standard is 250 g/mi, corresponding to 35.5 mpg, if all reductions were made through fuel economy improvements.

The proposal and related documents can be found at EPA's Office of Transportation and Air Quality (OTAQ) web site: *www.epa.gov/otaq/climate/regulations.htm*

Table: Projected fleet-wide emissions compliance levels under the proposed footprint-based CO_2 standards (g/mi) and corresponding fuel economy (mpg)

	2012	2013	2014	2015	2016
Passenger Cars (g/mi)	261	253	246	235	224
Light Trucks (g/mi)	352	341	332	317	302
Combined Cars & Trucks (g/mi)	295	286	276	263	250
Combined Cars & Trucks (mpg)	30.1	31.1	32.2	33.8	35.5

G8 backs two degrees climate goal

On 8 July leaders of the world's eight leading industrialised nations meeting in Italy agreed in principle a goal to limit global temperature rises to two degrees Celsius. The G8 group´s member coubntries are Canada, the Russian Federation, France, Germany, Japan, Italy, the United Kingdom, and the United States, together with the European Union.

This is the first time scientists' recommendations have been endorsed at such a high political level. G8 leaders had previously agreed to halve their greenhouse gas emissions by 2050.

Carbon dioxide cuts divides car makers

Some car producers perform far better than others when it comes to cutting carbon dioxide emissions.

In 2008, the best-performing car makers managed to achieve CO_2 emission cuts of up to five times those by the worst manufacturers. According to figures published by Transport & Environment (T&E), BMW lead the field with 10.2 per cent cuts in average CO_2 emissions on 2007 levels, and Mazda came second with 8.2 per cent reductions for cars sold in Europe in 2008. But nine of the 14 volume producers in the ranking achieved just 4 per cent or lower.

Last year´s winner.

Progress slowed dramatically at Fiat and Peugeot-Citroën (PSA), who have Europe's cleanest fleets on average and are close to meeting their EU targets. Both are now below 140 g/km. Conversely Suzuki and Mazda, who have been slow to improve efficiency in the past, and consequently have a long way to go to meet EU targets, made big steps forward in 2008.

In December 2009 the EU agreed on a regulation to reduce fleet-average CO_2 emissions of cars sold in Europe to 130 grams per kilometre (g/km) by 2015, and to 95 g/km by 2020. The new law replaced the failed voluntary commitment by the European car industry, dating back to 1998. Overall the average improvement in 2008 was 3.3 per cent, which is more than in any other year under the voluntary commitment.

The emission level of 130 g/km corresponds to a fuel consumption of approximately 5.6 litres per 100 km for petrol cars and 5.0 litres for diesel cars. That is 18 per cent below the average in 2007, which stood at 158 g/km.

Jos Dings, director of Transport & Environment said: "Clearly regulation is working – and if it works for cars, it will work for vans where progress so far has been even worse. Fuel efficient vans will be good for the environment, and save billions on fuel costs for the many businesses, small and large that depend on them."

Vans now represent 13 per cent of light vehicle (car and van) sales in Europe, but the share is increasing rapidly. Sales of vans have increased by 50 per cent over the last decade. The European Commission is expected to soon announce legally-binding targets for vans.

Source: T&E, 14 September 2009. Download the report "Reducing CO_2 Emissions from New Cars: A Study of Major Car Manufacturers' Progress in 2008" from: *www.transportenvironment.org/Printer/News/2009/9/Caremakers-divided-on-CO2-cuts/*

Global climate change causing 315,000 deaths every year

Climate change is currently causing some 315,000 deaths each year through hunger, sickness and weather disasters, and the annual death toll is expected to rise to half a million by 2030, according to a study, commissioned by the Geneva-based Global Humanitarian Forum (GHF).

It is estimated that climate change seriously affects 325 million people. In twenty years' time that number will more than double to an estimated 660 million, making it the biggest emerging humanitarian challenge in the world, impacting on the lives of ten per cent of the world's population.

Economic losses due to climate change already amount to over US$125 billion per year, more than the total amount of aid that currently flows from industrialised countries to developing nations each year. By 2030, the economic losses due to climate change will have almost trebled to US$340 billion annually.

For more information and to download the report, see: *http://ghfgeneva.org/Media/PressReleases/tabid/265/EntryId/40/Climate-Change-responsible-for-300-000-deaths-a-year.aspx*

Carbon offsetting criticised

The push by industrialised countries to offset their carbon emissions is undermining the fight against climate change, warned Friends of the Earth International (FoEI) in a report released at the start of key UN climate talks taking place in Bonn in June 2009.

FoEI claims that carbon offsetting is ineffective and damaging, and that it is a con which is failing to reduce, and in some cases is even increasing, carbon emissions. Moreover it is delaying vital infrastructure change, putting the lives and livelihoods of millions of people at risk and is worsening inequality between rich and developing countries' levels of emissions.

Information: *www.foei.org/en/media/archive/2009/carbon-offsetting-exposed-as-con*

Commission scrutinizes air quality derogations

The EU Commission has approved time extensions for 19 air quality zones, but raised objections to 75 other proposed exemptions.

On 2nd July the European Commission adopted nine decisions addressed to Austria, Belgium, Denmark, France, Germany, Greece, Hungary, Slovakia, and Spain concerning temporary exemptions from the EU's air quality standards for fine particles (PM_{10}).

According to EU's air quality legislation, the PM_{10} limit values should have been achieved in all member states by 2005, but the 2008 air quality directive (2008/50/EC) opens the way for member states, under strict conditions and for specific parts of the country, to extend the time for meeting the PM_{10} limits until June 2011, subject to approval by the Commission.

Environment Commissioner Stavros Dimas said: "Air pollution from PM_{10} has serious impacts on human health and compliance with the standards must be our priority. Several member states failed to comply with the deadline of 2005 for meeting the standards and are still not in compliance. The Commission therefore expects member states to clearly demonstrate that they are doing their utmost, in the interests of their citizens, to comply with the EU standards in the shortest possible time."

In its decisions, the Commission approved time extensions until June 2011 for 19 air quality zones in Austria, Germany and Hungary, but raised objections to the other 75 proposed exemptions.

For those remaining 75 zones, the Commission considered that the conditions had not been met, in many cases because insufficient data had been provided or because the measures outlined in the air quality plans submitted do not demonstrate that the standards will be met at the end of the exemption period.

Member states have an opportunity to re-notify for zones where the Commission has raised objections if they provide new information to demonstrate fulfilment of the conditions.

MARKUS BRETTSCHNEIDER/FOTOLIA

Exemption zone.

The conditions for assessment of national notifications for time extensions can be summarised as follows:

- All appropriate measures must have been taken before the initial attainment date to achieve compliance, i.e. before 2005 in the case of PM_{10}.
- The cause of the exceedances must be due to one or more of the following factors: transboundary air pollution from other countries; adverse climatic conditions; or site-specific characteristics affecting how pollution is dispersed.
- Compliance must be achieved by the expiry of the exemption period (June 2011 for PM_{10}). For each air quality zone an air quality plan must be prepared setting out the planned measures to ensure compliance.

Following notification from a member state, the Commission has nine months within which to raise objections, otherwise the exemption is deemed to have been approved. If objections are raised and the limit values continue to be exceeded, enforcement action will be taken.

In January 2009, infringement proceedings were launched against ten member states – Cyprus, Estonia, Germany, Italy, Poland, Portugal, Slovenia, Sweden, Spain, and the UK – for failing to comply with PM_{10} limit values.

In April 2009 the Netherlands was the first country to have a request for extensions approved by the Commission, which then agreed to an exemption from the PM_{10} limit values in all Dutch air quality zones, as well as the postponement of the NO_2 limit values until 2015, except for one zone where the extension was set to apply until end 2012.

Decisions on derogation requests from eight countries – Bulgaria, Cyprus, the Czech Republic, Italy, Latvia, Malta, Poland, Portugal, and the UK – are expected from the Commission before the end of the year.

Christer Ågren

Note: EU air quality legislation sets binding limit values and/or indicative target values for the maximum permitted concentrations of certain air pollutants. There are two binding air quality limit values for particulate matter (PM_{10}) based on daily and annual average concentrations, respectively. These entered into force on 1 January 2005. The air quality directive 2008/50/EC entered into force in 2008 and allows member states to notify time extensions for PM_{10}, NO_2 and benzene. During the time extension period the limit values continue to apply plus a margin of tolerance.

For more information: *ec.europa.eu/environment/air/quality/legislation/time_extensions.htm*

High Noon for 2°C

Introduction: The growing alliance

The world's nations agreed to "prevent dangerous anthropogenic interference with the climate system" (Art. 2 of the United Nations Framework Convention on Climate Change[1]) back in 1992. Until recently, most nations had not agreed what that meant, however. Over the past year, the group of countries that have agreed on a specific goal, namely to limit global warming to below 2°C or 1.5°C, has grown enormously: it now comprises 133 countries[2]. In June 2009 even the US agreed to the G8 target of limiting global warming to 2°C. Overall, the total group of countries calling for warming to be limited to 2°C degree or less accounts for about 75 per cent of global energy and industry-related CO_2 emissions[3] and about 80 per cent of the global population[4] in 2005. Good news for Copenhagen?

It is good news, because such warming limits can be directly translated into how much emissions we can still afford without crossing that threshold. The size of the overall emission cake is thus defined, although how that cake is divided between the countries and over what time frame is now the issue on the negotiation table. But this is where the good news ends.

While calling for 2°C, countries are still claiming for themselves too large a slice of the cake. In other words, the pledges on the table for Copenhagen do not take us where we need to be heading: Straight towards a near-zero carbon future towards the end of the century.

This factsheet aims to shed some light on the 2°C target and our chances of keeping warming below this.

AirClim

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Section 1: Background on 2°C

The origins of 2°C

Based on the available scientific evidence of severe regional impacts in the late 1980s an Advisory Group formed by the World Meteorological Organization, the International Council of Scientific Union, and the United Nations Environment Program recommended 2°C global mean surface warming from pre-industrial levels as "an upper limit beyond which the risks of grave damage to ecosystems, and of non-linear responses, are expected to increase rapidly"[5]. Further on, the German Advisory Council on Global Change[6] recommended a 2°C target based on the idea that warming should be kept within limits known from recent warm periods (interglacials). In 1996 after consideration of the IPCC Second Assessment Report (SAR)[7], which highlighted the severe impacts that can be expected for warming levels above 2°C, the European Union first established its 2°C target[8].

Is 2°C a scientific target?

Is 2°C a scientific target or an unscientific one? Neither. It is a policy target based on science, much like a speed limit for car traffic. Any such target is a value judgment made by policy makers, and hopefully, informed by science in regard to the consequences if we did not limit global warming to below 2°C. With growing scientific insight, as assessed in the Fourth IPCC Assessment Report (AR4), it is hard to conclude anything else but that preventing "dangerous anthropogenic interference with the climate system" means limiting global mean warming to no more than 2°C, and likely much *less*.

On the one hand, some legitimately claim that today's climate change impacts are already dangerous (e.g. remember the heat wave victims in Europe in 2003[9,10]). Even though we have only thus far faced a relatively mild global warming of 0.8°C, we have observed unprecedented mass coral bleaching events caused by unusually high sea temperatures[11], unprecedented heat waves and an increase in the most intense and destructive tropical cyclones linked to rising sea surface temperatures[12].

Given the information in the IPCC AR4, and what has been observed and projected since then, a value system that would call for any goal warmer than 2°C, seems to border on the absurd. Not labelling impacts as the complete extinction of coral reefs, even more severe droughts in the Mediterranean area[13], an abrupt transition to semi-arid state in the South-West USA[14], probably more intense cyclones[15], or the near certainty of multi-metre sea level rise in the long-term[16] as "dangerous" would certainly be a value judgement. But such a judgment would however most likely not be shared by most people.

2°C is not a safe level

Of course, 2°C is not a "safe level". That is why 80 of the most vulnerable developing countries are calling for global warming to be limited to below 1.5°C instead of below 2°C. This group comprises the Alliance of Small Island States (AOSIS) and the group of Least Developed Countries (LDC) that are most vulnerable to climate change. For these countries,

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a global warming of 2°C is projected to cause unacceptable damage. Long-term sea level rise is likely to end the history of many of the low-lying islands, even at 2°C warming.

At this level of warming, if not before, Arctic summer sea ice is likely to disappear, and with it unique ecosystems and ice-dependent species such as the Polar bear. We cannot rule out the possibility that accelerated melting of the Greenland ice sheet and disintegration of the West Antarctic ice sheet could be triggered below 2°C, inundating populous river deltas and low-lying coastal areas around the earth in coming centuries. Limiting global warming to below 2°C would certainly help to avoid the worst of impacts. Hence, 2°C is often thought to be the threshold, beyond which we would face unmanageable risks.

Section 2: Can 2°C be avoided?

GHG concentrations are already at around 450 ppm CO_2eq, how can we avoid 2°C?

The atmosphere is already loaded with greenhouse gases – sufficiently so that a warming of 2°C is likely to result if two conditions are met: Firstly, that greenhouse gas concentrations stay at today's levels, and secondly, that all cooling agents, i.e. aerosols, are eliminated.

The question is then, are we already committed to 2°C? No, we are not and the following paragraphs explain why.

The total of all anthropogenic warming and cooling influences on the climate determines the global average temperature. The figure of 450 ppm CO_2eq only includes the warming effects of the greenhouse gases CO_2, CH_4, N_2O, and various types of fluorocarbons, including HFCs, but not the cooling effect of aerosols. The effect of aerosols is to reduce the combined climate changing effects of all GHGs to close to the effects of CO_2 alone – around 385 ppm CO_2eq.

If we were to reduce all emissions instantly, then concentrations would fall again. In the case of CO_2, a substantial amount would still be redistributed to the oceans and the biosphere. For other gases, finite atmospheric lifetimes would result in their concentrations slowly falling back to the natural background levels.

Therefore, a commitment is probably best defined by the emission scenario that leads to the highest possible rate of reductions that is considered economically, and technically feasible without causing major disruptions to energy services, for example. The resulting "committed" concentrations will thus first increase above today's levels, but then fall again below these in the long term. In other words, we are not committed to stay at or above today's greenhouse gas concentrations. It is a choice.

Even if the aerosol cooling shield is taken away in the longer term (since this is very advisable for multiple reasons, primarily air quality), the resulting warming does not have to exceed 2°C[17]. The lower scenarios assessed in the IPCC Fourth Assessment Report, for example, all greatly diminish the emissions of aerosols up to the middle of the century, and yet these lower scenarios are able to limit maximal warming to below 2°C (Table 3.10 of IPCC AR4, WG III[18]). Figure 1 also shows GHG concentrations and global mean warming for a scenario that includes substantial removal

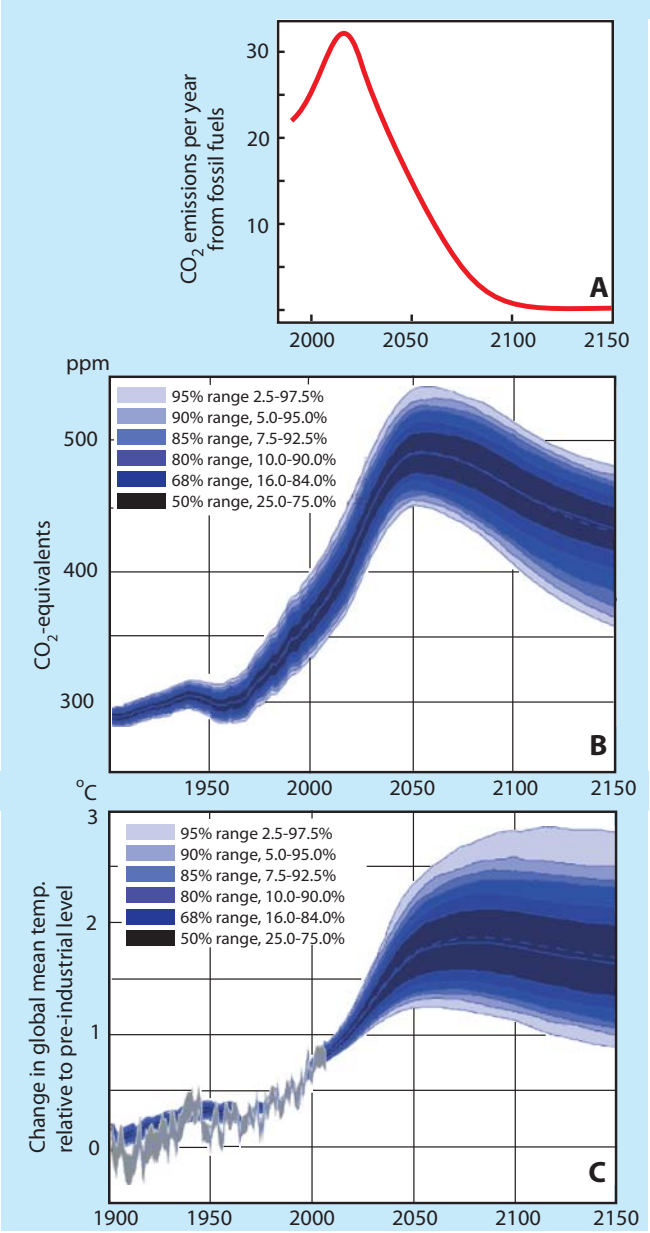


Figure 1. A: CO_2 emissions from fossil fuels under a mitigation scenario assuming halved global Kyoto GHG emissions by 2050 relative to 2000 levels (Schellnhuber, 2008)[17]. **B:** Resulting GHG concentrations + aerosol effects translated into CO_2eq concentrations. Calculations are based on the reduced complexity carbon cycle model MAGICC6.0[19]. Uncertainty ranges are calculated applying the statistical methodology introduced by Meinshausen et al., 2009[20](also see Appendix). **C:** Resulting changes in global mean temperature relative to pre-industrial levels.

of cooling air pollutants in parallel with the substitution of fossil fuels and technological innovation. Following the upper band of the emission reduction goal endorsed by the G8, in this scenario global Kyoto GHG emissions are halved by 2050, as in Schellnhuber, 2008[17]. This is virtually certain to overshoot the 450 ppm CO_2eq line (even including the aerosol effect), while there is about a one-in-three probability, or slightly higher, of exceeding the 2°C target.

Finally, we are basically bound to exceed 450 ppm CO_2eq (even including cooling agents) for some decades. Only if global emissions start to fall immediately by roughly 7 per cent annually, would the net forcing stay below that of 450 ppm CO_2eq. As shown in Figure 1, this concentration overshoot does not have to result in exceeding 2°C temperature levels. The phenomenon is similar to cranking up the ther-

mostat on a kitchen oven to 220°C, with the greenhouse gas concentrations being the thermostat. If the oven is turned down fast enough the actual temperature in the oven will never reach 220°C.

In summary, there is no reason for complacency. To ensure a safe climate future in the long term, we will have to turn back the atmospheric CO_2eq concentrations. The first and most important requirement to halt any further increase in concentrations is to lower emissions again. The peak has to be reached as soon as possible in order to get on a downward path – at least from 2015 onwards[21]. Only if global emissions are thereafter reduced sufficiently quickly, can we also stop the further rise in global mean temperatures. To halt the rise in sea level, there is simply no other way than to remove CO_2 from the atmosphere. Only these "negative" emissions will then allow us in the long term to return to CO_2 concentration levels below 350 ppm CO_2, as proposed by Hansen et al., 2008[22] – with some chance at least of limiting the rise in sea levels.

Would it be worthwhile to focus on the short-lived warming agents?

There is one additional very important aspect with respect to aerosols: Although overall they are estimated to have a cooling effect (-1.4 W/m^2 according to Ramanathan and Carmichael, 2008[25] and -1.2 W/m^2 according to IPCC AR4 WG I[23]), black carbon (BC) is one component with a pronounced warming effect (+0.20 (0.05, 0.35) W/m^2 solely from fossil fuel BC (IPCC AR4 WG I[23]); +0.9 (0.65, 1.15) W/m^2 according to Ramanathan and Carmichael, 2008, including other sources as biomass burning). Thus, reducing black carbon emissions will help to reduce global warming. These black carbon emissions mainly stem from cooking with biofuels, fossil fuel combustion (especially diesel and coal), and biomass burning associated with deforestation and crop residue burning. Therefore reducing black carbon emissions would not only have tremendous benefits in terms of increasing (indoor) air quality. Because black carbon on snow can decrease the albedo of snow and ice-covered areas, reducing black carbon emissions can be particularly beneficial for Himalayan glaciers or Arctic ecosystems.

However, none of these reductions should be made at the expense of focusing less on the main long-term culprit, CO_2. If short-lived species, such as black carbon and methane, as well as HFCs, are reduced in exchange for more emissions of gases with a long atmospheric residence time, a disservice is done to the climate. That is because in the longer term, when climate change is going to be magnitudes more dramatic than today, only the long-lived emissions of today count.

That is not to say that black carbon should not be reduced. On the contrary, reducing air pollution, extending the lifetime of Himalayan glaciers that supply water, and slowing current warming in the Arctic, are sufficient reasons to act swiftly. Tackling short-lived forcing agents is however not a substitute for CO_2 reductions. It is also important to recall that moving to an energy system that has very low CO_2 emissions will rapidly reduce black carbon emissions, however there is little or no synergy in the other direction. In other words moving fast on CO_2 will mean it is easier to move faster on black carbon.

Section 3: The size of the cake – what are the allowed emissions?

Many surprises in store for unique experiments

Translating a target of 2°C or 1.5°C into guidelines for global emission reduction targets over the coming decades is one of our most important and urgent tasks. We have to answer the question of what ceiling must be placed on emissions to keep global mean warming below these limits. It is this number which then allows an assessment of the targets. But unfortunately determining this number is not trivial: Whilst there is certainty about the fact that human-induced greenhouse gas emissions can and have caused global warming[26] it is not possible to predict the exact amount of warming that would result even for a certain emission trajectory. This depends on many factors such as: the amount of CO_2 taken up or released by the terrestrial biosphere and the oceans; the strength of radiative forcing associated with the concentrations of CO_2 and other greenhouse gases remaining in the atmosphere; and the cooling effect of aerosols and the fraction of warming that is buffered by the oceans. However, there has recently been a lot of progress in quantifying these uncertainties.

As with any unique experiments, and we are currently performing a big one with the Earth's climate, there are going to be surprises in store. In the history of humanity, the climate has never been pushed to warming levels that we are heading for. We cannot be certain that large positive feedback mechanisms such as the release of methane hydrate

Forcing	2005 Radiative forcing (W/m^2)	Best-estimate CO_2 equivalence concentration (ppm), if all below agents are included one by one[24].
CO_2	1.66 (1.49, 1.83)	380 CO_2
Methane (CH_4)	0.48 (0.43, 0.53)	415 CO_2eq (CO_2 + CH_4)
N_2O	0.16 (0.14, 0.18)	427 CO_2eq
Halocarbons	0.34 (0.31, 0.37)	455 CO_2eq
Tropospheric ozone	0.35 (0.25, 0.65)	486 CO_2eq
Stratospheric ozone	-0.05 (-0.15, 0.05)	482 CO_2eq
Land use	-0.20 (-0.40, 0.00)	464 CO_2eq
Black carbon on snow	0.10 (-0.00, 0.20)	473 CO_2eq
Direct effect of aerosols	-0.50 (0.90, -0.10)	431 CO_2eq
Indirect effect of aerosols	-0.70 (-1.81, -0.30)	378 CO_2eq

Table 1. Today's anthropogenic impact on the atmosphere. The human-induced radiative forcing agents, with the major culprit CO_2, are listed on the left, their radiative forcing (the measure of how much those agents contribute to warming) is listed in the middle column (taken from Table 2.12 in IPCC AR4, WG I[23]) and the corresponding best-estimate CO_2 equivalence concentration is listed on the right.

from the ocean floor as the seas warm up, are not going to be a major source of warming that will haunt us in the future. We cannot be certain about how exactly the carbon cycle reacts across the span of Earth's diverse ecosystems. But there are certainties as well. We know for certain that the climate will warm, and with 2°C warming it is clear that more terrestrial, freshwater and marine species are at risk than at any time in the recent geological past[27].

Risk management approach – quantifying allowable emissions

Given these uncertainties, climate change policies have to be seen as a risk management technique. As in so many other policy areas, we not only have to state the target, but also how certain we want to be of achieving it. The question hence becomes: "What is the allowed amount of emissions, if we want to keep global warming below 1.5°C or 2°C *with a probability of X%*?" For each emission path there will be a certain risk of exceeding a given temperature target due to the uncertainties of the projections – without even accounting for the potentially strong feedbacks mentioned above. Deciding on possible emission pathways is uncertain, as are most political decisions. But a lot of effort is spent in quantifying and reducing the uncertainties related to this special question.

There are four recent studies (Meinshausen et al., 2009[21] and Allen et al, 2009[28], Matthews et al. 2009[29] and Zickfeld et al. 2009[30]) which take a very comprehensive approach to quantifying the current uncertainties related to the question of what are the "allowed amounts" of global emissions. We focus here on the methodology which includes all greenhouse gases (Meinshausen et al., 2009):

Given any specific emission path, a reduced complexity carbon cycle climate model was used to estimate the probability of exceeding a global mean warming of 2°C in the 21st century. Therefore a large number of model runs were executed based on different sets of model input parameters varied within their uncertainty ranges. More details of the methodology are given in the Appendix.

Calculating these exceedance probabilities for a large number of emission profiles tells us that:

Generally, exceedance probabilities depend on cumulative emissions, i.e. emissions summed up over a long time period, not on the specific emission profile.

If we accept an exceedance probability of 25 per cent the cumulative CO_2 emissions from fossil sources and land use changes have to be limited to 1,000 Gt CO_2. If we are willing to accept a probability of even 50 per cent of warming exceeding 2°C, the limit is reached at 1,440 Gt CO_2.

We cannot afford to burn today's reserves

But what do the numbers 1,000 Gt CO_2 and 1,440 Gt CO_2 mean, respectively? Is there any hope that fossil fuel reserves are exhausted before reaching these limits? The answer is no. Burning the known economically recoverable oil, gas and coal reserves vastly exceeds the "allowed emissions" that will keep global warming below 2°C: Known CO_2 emissions from 2000 until now (2009) already total more than 300 Gt CO_2. Thus, we only have an allowance of less than 700 Gt CO_2 left if we are to retain a "likely"[31] chance (75 per cent) of keeping global warming below 2°C. Given that the amount of economically recoverable fossil fuel reserves is about 2,800 Gt CO_2[32,33], this is less than a quarter. Based on today's emission rates of 36.3 Gt CO_2/yr, the budget of 1000 Gt CO_2 will be exhausted by 2027. Furthermore, keep in mind that the overall resource estimates, including the unconventional sources, are probably many times larger than the economically recoverable reserves.

But using CCS will allow us to burn all fossil fuels!?

The short answer is no, and here is why: Carbon Capture and Sequestration (CCS) is an important technology; it is worthwhile supporting and important to make it available on a commercial scale, with sound solutions to resolve issues like permanence, leakage, transport etc. And yes, it is true: If the burning of fossil fuels in a coal power plant is combined with CCS, then that power plant is going to be carbon neutral.

So why then is CCS not a lifesaver for the coal industry? In order to achieve safe climate levels in the long term, e.g. a return to 350 ppm CO_2 concentrations, we will have to reduce all emissions basically to zero before the end of the century, and it is likely that CO_2 emissions will need to be close to zero shortly after mid-century. In fact, to prevent further sea level rise or ongoing ocean acidification, there is no way around negative CO_2 emissions. These negative emissions are for example possible with the combination of biomass power plants and CCS. Thus, we can simply not afford to waste the available geological storage sites for carbon dioxide from coal power plants, but will have to use them to suck carbon from the atmosphere. For these large point sources, such as power plants, carbon neutrality is simply not going to be good enough.

What does 2°C mean for 2050 emission levels?

Generally, one year's emissions do not provide enough information about cumulative emissions to deduce exceedance probabilities. High or low emissions in 2050 may be levelled off by especially low or high emissions in previous years. But given that we are discussing "plausible" real world emission pathways, emissions in 2050 actually become a robust indicator of exceedance probabilities. Given the default assumptions about climate sensitivity (see Appendix), it turns out that halving global emissions by 2050 relative to 1990 levels is not enough to achieve a 2°C target with a very high likelihood. There is still a one-third risk of exceeding 2°C.

As mentioned, this analysis makes assumptions about what a "plausible pathway" could look like. This basically comes down to "smooth" trajectories with maximum reduction rates of six per cent per year in the region with the strongest emission cuts, i.e. OECD. There are some sketches of pathways in the international arena that assume ever-increasing global emissions until 2030, and then crashing emission reduction rates between 2040 and 2050. We admire the optimism underlying those pathways, i.e. that it is feasible to achieve the very steep reduction rates with some miracle technology in the future. The IPCC Fourth

USA	**-80%**	-85%	**-90%**	-93%
EU27	-73%	**-80%**	-87%	**-90%**
Non-OECD	48%	10%	-26%	-45%
OECD	-72%	-79%	-86%	-90%
WORLD	-9%	-32%	-55%	-66%
AVERAGE PER CAPITA ($tCO_2eq/cap/yr$)	3.04	2.26	1.52	1.13

Table 2. Relationship between 2050 absolute emission levels relative to 1990 – assuming equal per capita emissions of Kyoto GHG excl. LULUCF (CRF[36]+MATCH[37]) in 2050. Numbers are based on Medium Growth UN 2008 Population projections.[38]

Assessment report did not share that optimism either, when it concluded that for the lower stabilisation categories a peaking of global emissions by 2015 is pivotal. However, even if emission levels were halved by 2050 after such a crash trajectory, the exceedance probabilities would be greater than merely a third – simply because the cumulative emissions over the first half of the 21st century are going to be too high.

Section 4: Sharing the "allowed" emission budget

How we should share the "allowed" emission budget among the countries of the world in a fair manner is at the core of the climate negotiations. For example, some developing countries point out the large historical contributions to emissions. Without even having to look backward, the current per capita emissions in industrialised countries are still significantly higher than per capita emissions in developing countries. In 2005, per capita emissions of greenhouse gases reached 23.5 tCO_2eq for the USA, 10.5 tCO_2eq for the EU-27, 5.4 tCO_2eq for China, and 1.65 tCO_2eq for India[34,35,36].

For any fair solution to avoid the worst climate impacts, the effort of reducing emissions has to be primarily shouldered by those emitting most on a per capita basis, which have the capacity to act, and contributed most to historical emissions, i.e. the climate change we face today. This is the group of OECD countries. Clearly, however, without leveling off emission in developing countries, such as China, by 2020, we will not be able to contain global emissions within the allowable remaining budget. Hence, not only is domestic action required by all countries, major finance and technological support has to be shouldered by the rich, in order to allow a zero-carbon development path for the poor.

In this article we do not prescribe any particular rules for dividing the remaining amount of allowed emissions associated with a reasonable chance of keeping global warming below 2°C. Rather, we follow a conservative approach in the sense that we do not consider historical emissions but simply assume equal per capita emissions in 2050. The fairness of such an approach can of course be questioned, rather like asking whether it is fair that those who are drunk at the end of a party should claim an equal share of the last bottle as those who have only had water so far (Nicholas Stern, Bali climate conference, 2007). On the other hand, the political realities seem to suggest that future generations in OECD countries might not be willing to sign up to financial transfers, once their per capita emissions turn to lower levels than those of currently developing countries. Anyway, for illustrative purposes, it is illuminating to sketch a world of equal per capita emission allocations in 2050, as done in Table 2.

Based on medium growth population projections (UN 2008) we can calculate the resulting reductions in global GHG emissions (expressed in CO_2eq) given that the USA and the EU-27 reduce their emissions by 2050 by the relative amounts printed in bold. Thus, the first column of Table 2 has to be read as follows: If the USA reduce their total (not per capita) emissions by 80 per cent relative to 1990 that means per capita emissions of 3.04 tCO_2eq. To reach the same per capita emissions in 2050, the EU-27, as a group, has to reduce their total emissions by 73 per cent. For the group of OECD countries this means emission reductions of 72 per cent while emissions are allowed to increase by 48 per cent in the non-OECD countries. But overall this means that global emissions are only reduced by 9 per cent – not enough to have a reasonable chance of staying below 2°C global warming. To limit the exceedance probability to 25 per cent, global emissions have to be reduced by 50 per cent or more. Assuming equal per capita emissions in 2050 this means that the USA has to reduce their emissions by ~90 per cent. For the EU-27 this means reductions of 87 per cent and in this case even the non-OECD countries have to cut their emissions by 26 per cent *(see column 3 of Table 2)*. Average per capita emissions of Kyoto GHG reach 1.52 tCO_2eq per year under this scenario.

Only under a scenario where the EU and the rest of OECD as a group reduce emissions allocations by 90 per cent relative to 1990 levels, will it be possible to have both equal per capita emission allocations by 2050 and global emissions substantially below 50 per cent.

US per capita emissions relative to EU per capita emissions

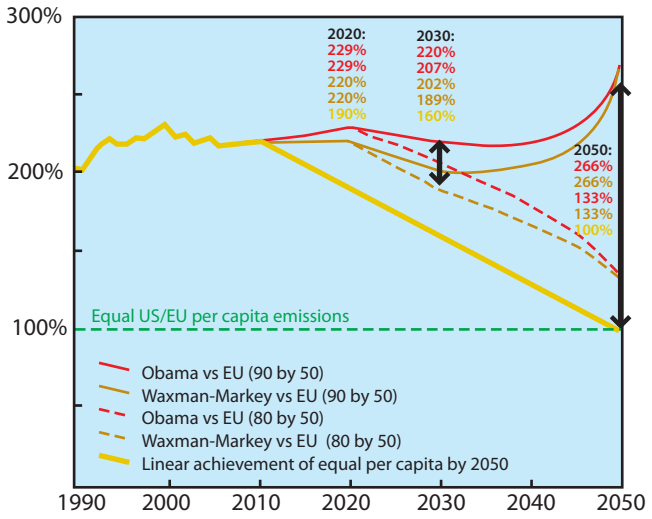


Figure 2. US per capita emissions in proportion to EU per capita emissions assuming that the EU reduces its GHG emissions by 90 per cent (solid lines) or 80 per cent (dashed lines) in 2050 relative to 1990. Ochre line: Linear decrease in proportions reaching from today's levels to equal per capita emissions in 2050. Orange lines: Assuming US emissions follow the Waxman Markey Bill. Red lines: Assuming US emissions follow the proposal by President Obama. (Assuming medium UN population growth projections; Kyoto GHG emissions (excl. LULUCF CO_2);EU27 target -30% rel. to 1990.)

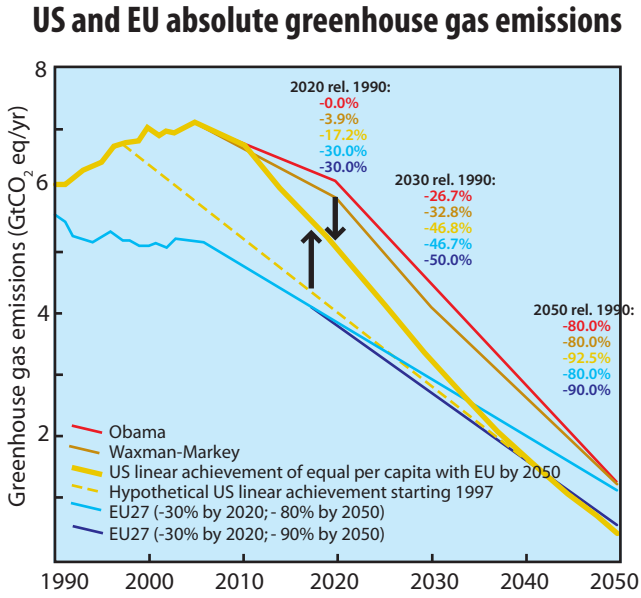


Figure 3. Projections of absolute GHG emissions per year from the US and EU-27 for different scenarios considered in Figure 2 (see legend). Thus, a -17 per cent target by 2020 for the US would be substantially below implied levels of the Waxman/Markey bill (orange line), as shown by the black downward arrow. Considering a hypothetical starting year of per capita convergence at the time of Kyoto (1997), the -17 per cent US reduction by 2020 is relatively "mild", as shown by the black upward arrow. (Kyoto GHG (excl. LULUCF CO_2 emissions); CRF UNFCCC 2008; extended beyond 2009 according to target proposals.)

-17% allocations by 2020 for the US might be fair – relative to 1990 levels, not 2005

The Waxman-Markey/HR[37] bill is a great step for US legislation on climate change, implying around 17 per cent emission reductions below 2005 by 2020 for its cap including the additional measures[38]. However, it is insufficient in regard to its 2020 targets. Consider for example that EU and US per capita emission allocations should be equalised by 2050, as described above. Assume furthermore that a fair path towards that 2050 target might simply be a straight line, so that the ratio between US and EU-27 per capita emissions steadily diminishes from its current factor of 2.3 to 1 by 2050. Then, if the EU aims for a 90 per cent reduction by 2050, US emissions by 2020 would need to be 17 per cent below 1990 levels – already taking into account the fact that the US population is steadily rising. *(See Figure 3.)*

Section 5: The big gap:

The announcements do not add up to reach the goal

The Copenhagen climate meeting (December 2009) is an opportunity, maybe the last one, to set the world on an emission pathway that turns around before 2015. Currently, emissions are ever increasing, and so is the risk to coral reefs, river deltas, and increasingly drought-struck and water-scarce areas. As the deadline of Copenhagen approaches, industrialised countries have started to put their pledges for future emission reductions on the table. Some developing countries have also put in place or planned policies which would reduce the growth of their emissions. What do all these pledges and climate policy initiatives and proposals mean with respect to achieving the 2°C (1.5°C) target? Are current proposals sufficient to reach that target? Unfortunately, the short answer is no.

Looking at global emission reductions, it is necessary to consider the reduction targets or policies of both developed and developing countries. Rogelj et al., 2009[35] have calculated that the overall number of countries for which it was possible to deduce future emissions accounts for about two thirds of the world's population. This group accounts for 76 per cent of global GHG emissions in 2005. Rogelj et al., 2009[39], have compiled all these pledges to create a global emission path up to 2100. Wherever it was not possible to specify a country's position, emissions are assumed to follow a Business As Usual (BAU) scenario up to 2100 (SRESA1B, Nakicenovic and Swart, 2000[40]).

Assuming the best option whenever a range of reductions is specified ("current best scenario") and constant emissions after 2050 whenever a 2050 target was set, Rogelj et al. found that global emissions will increase by 42 per cent relative to 1990 in 2020. In 2050 total emissions are projected to be 80 per cent higher than 1990. Given this there is virtually no chance to limit global warming to 2°C. The exceedance probability reaches 100 per cent, based on the methodology of Meinshausen et al., 2009. Even the risk of exceeding 3°C global warming by 2100 is greater than 50 per cent. Atmospheric CO_2 concentrations are projected to exceed 550 ppm by the middle of the century. This is a level at which coral reefs are predicted to dissolve due to ocean acidification (Silverman et al., 2009)[41].

Conclusion

Thus, while the good news is that countries have 1.5 and 2°C in mind, their current aspirations are simply not sufficient to get there. Closing this gap, i.e. coming up with deep reduction targets, and sufficient financial support for additional reductions in developing countries, is the key challenge for Copenhagen. This challenge is only matched by the attempts of some parties to derail the international architecture under which the mutual trust of nations can flourish. An international agreement that is reduced to a collection of pledges, where each nation plays only according to its own rules and each nation verifies its own achievements, is unlikely to create an atmosphere in which we believe our neighbors are doing their fair share and in which we will bring global emissions to a halt any time soon. It will be rather like living in the Wild West. A hot Wild West.

Acknowledgement

We thank Kirsten Macey for very helpful comments to this manuscript.

An extended version of this factsheet, including a section on methods, a full list of references and a presentation of the authors is available at: *www.airclim.org/factsheets/index.php*

Cutting ship fuel sulphur may save 45,000 lives

Lowering the sulphur content of fuel used in shipping could prevent upwards of 45,000 premature deaths a year by reducing exposure to fine particles.

Lowering the sulphur content of fuel used in shipping could prevent upwards of 45,000 premature deaths a year by reducing exposure to fine particles, according to a study published recently.

Ship emissions of sulphur oxides are directly related to the sulphur content of the fuel oil. For ocean-going vessels, fuel sulphur content averages around 2.7% with an upper limit as high as 4.5% .

Once emitted, sulphur oxides react with other pollutants in the air, such as nitrates or ammonium, to form very small particles. Moreover, the burning of high-sulphur heavy fuel oils also results in higher emissions of so-called primary particles (particulate organic matter and black carbon), as compared to using lower-sulphur distillate fuels, i.e. diesel oil and gas oil. Fine particles, which are less than 2.5 micrometres across, are thought to be the most hazardous group of particles, and have been linked to cardiopulmonary disease and lung cancer.

In an earlier research paper, two of the co-authors of the current study concluded that pollution from international marine shipping in 2002 caused approximately 64,000 premature cardiopulmonary and lung cancer deaths around the world each year *(see AN 4, 2007)*. In that paper, they estimated that the annual mortalities from ship emissions could increase by 40 per cent by 2012, to nearly 90,000 deaths.

In this new study, a 2012 "No Control" scenario (assuming 2.7% fuel sulphur content) was compared with three emission control scenarios. Two of these represent cases where marine fuel sulphur content is limited to 0.5% and 0.1% content, respectively, within 200 nautical miles (370 kilometres) of coastal areas. A third emission control scenario represents a global limit of 0.5% sulphur content.

Requiring ships either to use marine fuel with a maximum of 0.5% sulphur globally or alternatively 0.1% sulphur content within 200 nautical miles (nm) of coastal areas, could reduce annual premature deaths by around 45,000 by 2012, i.e. approximately 50 per cent of the 87,000 deaths estimated to occur in the no control scenario. A limit of 0.5% sulphur within 200 nm could reduce the number of premature deaths by about 34,000.

According to the authors, these results confirm that meaningful benefits are achieved from either a 0.5% or a 0.1% sulphur control strategy. The study demonstrates the clear benefits of reducing sulphur emissions globally, not just in coastal regions, as particles can be carried long distances in the atmosphere. It also shows that stricter limits within Emission Control Areas *(see box)* will bring additional health benefits.

The premature mortality impacts demonstrated by the study are only two of many impacts that are related to shipping emissions and fuel quality, the authors point out. Climate change, acidification, visibility, eutrophication, and other environmental effects are also closely related to the type of fuel used in ships.

Christer Ågren

Source: Mitigating the Health Impacts of Pollution from Oceangoing Shipping: An Assessment of Low-Sulfur Fuel Mandates. By J. Winebrake, J. Corbett, E. Green, A. Lauer and V. Eyring. Published online in the American Chemical Society journal Environmental Science & Technology on 3 June 2009. Volume 43, No. 13, pp 4776–4782.

HELGO/FOTOLIA

Enjoying the Baltic ECA.

International ship emission regulations

The International Maritime Organization (IMO), under ANNEX VI of MARPOL 73/78 (the International Convention for the Prevention of Pollution from Ships), has adopted controls on sulphur in marine fuels.

The global fuel sulphur limit is currently 4.5%, and will be reduced to 3.5% in 2012 and then further lowered to 0.5%, but not until 2020.

In specially designated sulphur emission control areas (SOx-ECAs), the current limit is set at 1.5% sulphur. It will be tightened to 1% by July 2010 and to 0.1% by 2015.

There are currently only two existing SOx ECAs, the North Sea and the Baltic Sea. Earlier this year, the USA and Canada proposed that IMO should designate most areas of their coastal waters (within 200 nautical miles of coastal areas) as an ECA. The proposal is expected to be approved by IMO in March 2010.

Note that exhaust gas cleaning systems (e.g. scrubbers) that achieve equivalent sulphur emission reductions may be used as an alternative to low-sulphur fuels.

New multi-pollutant scrubber

The Singapore-based company Ecospec says its $CSNO_x$ scrubber is the first commercially viable solution capable of reducing carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen oxide (NOx) and particulate matter (PM) emitted by ships within a single system.

The US classification society American Bureau of Shipping (ABS) has witnessed the testing of the scrubber system at a shore-based test rig, verifying that the system was capable of removing more than 99 per cent of SO_2, 50–80 per cent of NOx, and some 30–55 per cent of CO_2.

Starting this autumn, sea trials of the scrubber system onboard tankers will be witnessed and verified by ABS and the Maritime and Port Authority of Singapore as part of the IMO type approval process for an exhaust gas cleaning system.

Source: Presentations by Ecospec and ABS at IMO in London, 16 July 2009

ARTURO LIMON/FOTOLIA

Cleaning the air in Long Beach.

Port to test 'sock on a stack' system

The Californian Port of Long Beach is testing a 'sock on a stack' system which could cut emissions from ships by up to 95 per cent. The Advanced Maritime Emissions Control System (AMECS) uses a crane to place a large bonnet-like device over a ship's smokestack. The exhaust from the ship's diesel engines is then captured and scrubbed of harmful air pollutants before being released back into the atmosphere. AMECS could be used to cut pollution at berths that are not outfitted with shore power.

Source: Sustainable Shipping News, June 2009

Shipping climate policy continues to drift

BIRGIT REITZ-HOFMANN/FOTOLIA

Here comes the IMO!

Once again, the IMO has failed to adopt binding measures to reduce emissions from international shipping.

At a meeting in July, the International Maritime Organization (IMO) was unable to agree on a plan that would cut greenhouse gas emissions by the shipping industry.

A two-year work plan to develop so-called market-based instruments was watered down at a session of the IMO's Marine Environment Protection Committee (MEPC), after pressure from China, Saudi Arabia and South Africa.

Global measures to reduce emissions, in the form of a fuel levy or an emissions trading scheme, have been identified, but any decision to adopt either instrument will not be taken before 2012 at the earliest and could take a further 5–10 years to enter into force, so in practice it could be 2020 before the measure takes effect.

Shipping currently accounts for more than 1 billion tonnes of CO_2 emissions per year (3.3% of global emissions). Without emissions reduction policies, scenarios suggest that ship emissions may double or even triple by 2050 as world trade grows.

The MEPC meeting saw the conclusion of several years' work on developing energy efficiency indices for the design of new vessels and the operation of existing ones, which could be used as very effective tools to make shipping more energy efficient. However, so far the IMO only intends to use these indices in voluntary trials.

"The energy efficiency measures are a welcome development, but on their own they will not achieve the greenhouse gas emission reductions needed. And they won't achieve anything at all, unless they are mandatory, with an increased reduction of permitted emissions over time, so that the industry is forced to build and sail ever-cleaner ships," said Pete Lockley at WWF-UK.

It is now twelve years since the UN Framework Convention on Climate Change handed responsibility to IMO to address emissions of greenhouse gases from international shipping, but the organisation still has not adopted one single binding measure to do so.

Source: Press release by WWF-UK, Transport and Environment (T&E), Seas At Risk, Friends of the Earth US, Oceana, Clean Air Task Force, and Bellona, 17 July 2009.

See also the report **"Bunker fuels and the Kyoto Protocol: How ICAO and the IMO failed the climate change test"** (June 2009), by the European Federation for Transport and Environment (T&E). www.transdportenvironment.org/Pages/shipping

North American ECA met by approval

The process of establishing an emission control area (ECA) off the North American shores has taken a step further.

The Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) in July approved in principle a joint US/Canadian proposal to establish an emission control area (ECA) reaching 200 nautical miles (370 kilometres) off the Atlantic and Pacific Ocean shores of the two countries *(see AN 2/09, pp. 1, 4–5)*. The proposal is now set for formal adoption at the next MEPC meeting in March 2010.

In the debate, China criticised the proposed ECA for being too large in size, citing fears that it could set a precedent for forthcoming ECA applications, which could eventually lead to "most shipping areas becoming ECAs", while Japan expressed concerns about availability of low-sulphur fuel to meet demand.

According to the revised MARPOL Annex VI, exhaust gas cleaning systems or other technical measures can be used as an alternative to low-sulphur fuels to achieve the emission sulphur reductions set out in the Annex.

Based on input from an expert group, the MEPC approved guidelines for discharge of washwater from exhaust gas cleaning systems (scrubbers), but with the provision that there will be a review sometime after 2010, as more data becomes available on the contents of the discharge and its effects.

The need for more detailed and possibly also legally binding fuel quality standards has been under debate for some time. As a result, last year the IMO invited the International Organization for Standardization (ISO) to revise their current fuel standards, aligning them with the needs of the revised Annex VI.

ISO reported back to the MEPC meeting in July, but the recommended quality parameters and limit values suggested by the ISO failed to satisfy the MEPC, with several points of concern raised by member states. Consequently, the ISO was asked to come back next year with a revised proposal.

Note: Annex VI "Regulations for the prevention of air pollution from ships" of the IMO's MARPOL Convention was adopted in 1997 and entered into force in 2005. The revised Annex VI, as adopted in October 2008 will enter into force on 1 July 2010.

The new North American emission control area (ECA) (green lines).

DFDS installs scrubber

Danish ferry operator DFDS Tor Line is currently equipping its vessel Tor Ficaria, which operates between Gothenburg and Immingham in the UK, with a scrubber system to reduce the sulphur content in its exhaust fumes and meet forthcoming IMO regulations. Scrubbing technology uses a process whereby a system in installed in the ship's funnel and salt water is added to the flue gases to remove the sulphur. According to Per Marzelius, Head of Ship Management at DFDS Tor Line, the investment in scrubbers is a means of complying with the new, stricter sulphur regulations and contributing to a cleaner environment.

Source: PortGot News, 17 June 2009

Certified SOx scrubber

Marine engine manufacturer Wärtsilä has launched a closed-loop fresh water scrubber to which sodium hydroxide (NaOH) is added in order to neutralise sulphur oxides (SO_x). If operation in zero discharge mode is requested, the effluent can be led to a holding tank for scheduled and periodic discharge. The Wärtsilä SO_x scrubber has been granted the Sulphur Emission Control Area (SECA) Compliance Certificate.

Measurements have demonstrated a sulphur dioxide removal efficiency exceeding 99 per cent. The reductions in particulate matter and nitrogen oxides were 30–60 per cent and 3–7 per cent, respectively.

Source: Press release from Wärtsilä, 10 September 2009.

World's first tanker to cold-iron

The crude oil tanker Alaskan Navigator became the first tanker in the world to plug into a dockside electrical outlet, when calling at BP's oil terminal at Pier T in the Port of Long Beach in early June. The Pier T cold ironing facility can handle up to three cold-ironing-enabled tankers per month, which could cut NO_x emissions by the equivalent of 187,000 cars during each call.

Source: Wilhelmsen Marine Engineering, 16 June 2009

Not included.

EU transport emissions underestimated

Emissions of carbon dioxide (CO_2) from the EU transport sector are underestimated in official reporting because data submitted to the UN do not include international aviation and shipping, according to environmentalist group Transport & Environment (T&E).

The share of CO_2 emissions from international aviation and shipping continues to increase. In 2007 they accounted for 6.9 per cent of total EU emissions, and 24 per cent of transport emissions. In 1990, these figures were 3.8 and 18 per cent respectively. Between 1990 and 2007 aviation emissions more than doubled, while CO_2 releases from shipping rose by 60 per cent.

Source: T&E report **"CO_2 emissions from transport in the EU27: An analysis of 2007 data submitted to the UNFCCC"** (August 2009). Available from: *www.transportenvironment.org/Downloads/view/cid:3*

EU climate and energy laws published

A set of five new EU laws on renewable energy, greenhouse gas emissions trading (ETS), carbon dioxide emissions from passenger cars, carbon capture and storage (CCS) and fuel quality will now enter force after their publication in the EU's Official Journal on 5 June.

The laws together make up the climate and energy package adopted by the Council and the Parliament late last year. A Council Decision setting national emission reduction targets for sectors not covered by Europe's emissions trading scheme (ETS) is also published in the Official Journal.

The legislative texts can be downloaded from:*eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2009:140:SOM:EN:HTML*

Ministers water down pollution legislation

EU environment ministers have agreed to water down proposals for stronger industrial pollution control.

On 25 June EU environment ministers agreed to water down proposals to revise and strengthen EU legislation to control industrial pollution.

One of the main points of debate was

Essential equipment for environment ministers (Italian model).

the strengthening of binding emission limit values (ELVs) for large combustion plants (LCPs), i.e. power plants as well as larger combustion installations in oil refineries and other industries. In order to further reduce pollution from these sources, the Commission had proposed tightening the existing ELVs by bringing them into line with current Best Available Techniques (BAT) by 2016 *(see box)*.

Regarding newly constructed LCPs, the Council agreed that the Commission's proposed ELVs for sulphur dioxide (SO_2), nitrogen oxides (NO_x) and particulate matter (PM) should apply within two years after the entry into force of the directive, i.e. probably by 2012 or 2013.

Existing LCPs (those built before 2002) would in general have to apply stricter ELVs from 2016, but the agreement introduces an option for member states to postpone this requirement until 2021 by defining so-called transitional national plans (TNP) that cap emissions of certain pollutants. The annual emission ceilings under TNPs must decline between 2016 and 2020.

This type of postponement of stricter emission standards for existing plants was clearly rejected by the European Parliament at its first reading in March 2009.

The ministers also agreed a separate derogation from the emission limits for LCPs which are expected to have a limited remaining life-time, i.e. not operating more than 20,000 hours between 2016 and 2023.

Combustion plants that burn indigenous coal or lignite, which cannot comply with the emission limits for SO_2, will be allowed to alternatively apply a set minimum rate of desulphurisation. This rate is 96 per cent for existing LCPs with a rated thermal input of over 300 megawatts.

Among the countries most actively pushing for various types of derogations and time extensions from the ELVs were

Essential equipment for environment ministers (British model).

the UK, Poland, and Italy.

The Commission and the Council Parliament want to extend the scope of the directive by also including ELVs for smaller combustion plants between 20 and

50 megawatts, but this idea was rejected by the Council.

Another main point of contention was how much flexibility member states should be granted in applying best available techniques when determining pollution permits.

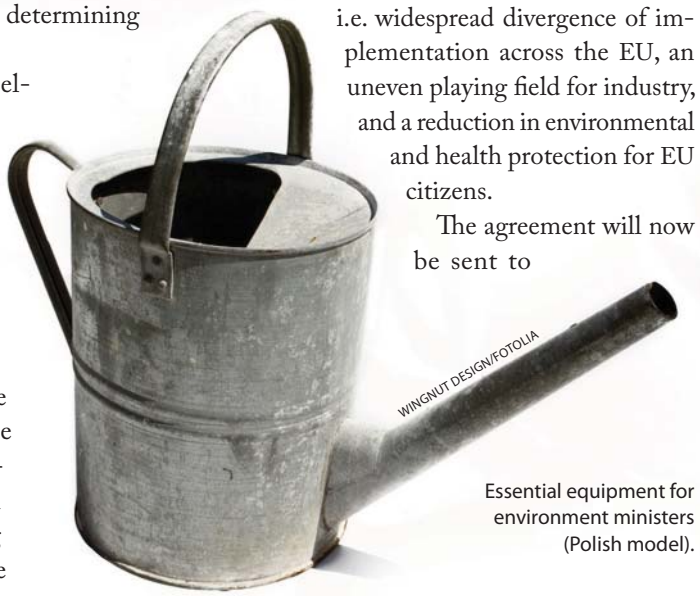
One of the core elements of the Commission's proposal was to strengthen the application of BAT compared to current legislation. By giving a more prominent role to BREFs, the scope for national authorities to deviate from BAT when issuing permits should be reduced.

A compromise proposal by the Czech presidency was eventually adopted by the Council, in spite of the fact that it was initially refused by a blocking minority of countries, including Belgium, Denmark, Germany, and Sweden, because it gave states too much space to deviate from the BAT-associated emission levels when issuing pollution permits.

In its comment to the Council's agreement, environmentalist organisation European Environmental Bureau (EEB) pointed out that keeping the current level of flexibility to derogate from BAT will lead to a business as usual approach, i.e. widespread divergence of implementation across the EU, an uneven playing field for industry, and a reduction in environmental and health protection for EU citizens.

The agreement will now be sent to the European Parliament for a second reading, which is expected to start late this year or early 2010.

Christer Ågren



Essential equipment for environment ministers (Polish model).

The Industrial Emissions Directive

The proposed new Industrial Emissions (IE) directive revises the existing directive on Integrated Pollution Prevention and Control (IPPC), and integrates it with six sector directives – the Large Combustion Plant (LCP), Waste Incineration and Solvent Emissions directives together with three Titanium Dioxide directives.

While setting out the principles for applying Best Available Techniques (BAT) for a wide range of industrial and agricultural activities, the IPPC directive does not set any binding emission standards. Instead, legally binding permits that should be based on BAT are set by national, regional or local authorities for each individual installation.

Guidance on BAT is provided by BAT Reference Documents (BREFs), which set benchmark BAT standards for each industrial sector and some cross-sectoral issues, e.g. energy efficiency. However, the BREFs are not legally binding.

The existing LCP directive sets binding emission limit values (ELVs), but these are lenient compared to the benchmark standards judged to be reasonable by the technical working group that in 2001 produced the LCP BREF. In its proposal, the Commission therefore proposes tightening them up, generally to the level of the least strict end of the BREF BAT standard range.

The new industrial emissions directive received its first reading in the European Parliament in March, and in the Council in June.

EU pledges billions for post-Kyoto climate agreement

Assuming an ambitious global climate change agreement is reached in Copenhagen in December, the European Commission estimates that developing countries will need financing of roughly €100 billion a year by 2020 to mitigate their emissions and adapt to climate change.

Much of the finance needed will have to come from domestic sources and an expanded international carbon market (e.g. emission taxes on global shipping, aviation and industry), but according to the Commission, international public financing of some €22–50 billion a year is also likely to be necessary.

In a policy paper presented on 10 September, the Commission proposes that industrialised nations and economically more advanced developing countries should provide this public financing in line with their responsibility for emissions and ability to pay. Depending on the weight of each factor, this would set the EU's contribution at somewhere between 10 and 30 per cent of the total, i.e. an EU contribution of some €2–15 billion a year by 2020.

But environmentalists said the figure for the EU was too low. "The EU is trying to get away with leaving a tip rather than paying its share of the bill to protect the planet's climate," Greenpeace campaigner Joris den Blanken said.

Greenpeace calls on industrialised countries to honour their climate pledge to the tune of at least €110 billion annually, and for the EU to commit €35 billion (on top of existing development assistance).

The Commission had previously indicated the EU might pay €13–24 billion, but retracted those numbers after deciding the United States should carry a heavier financial burden to compensate for its relatively modest emissions cuts.

Sources: Policy paper from the European Commission, 10 September 2009: *ec.europa.eu/environment/climat/future_action.htm,* and Greenpeace press release *www.greenpeace.org/eu-unit/press-centre/press-releases2/paying-climate-bill-10-09-09*

Still high ozone levels despite less air pollution

Ozone levels remain largely unchanged in many European countries, even though emissions of the air pollutants involved in ozone formation have been reduced significantly.

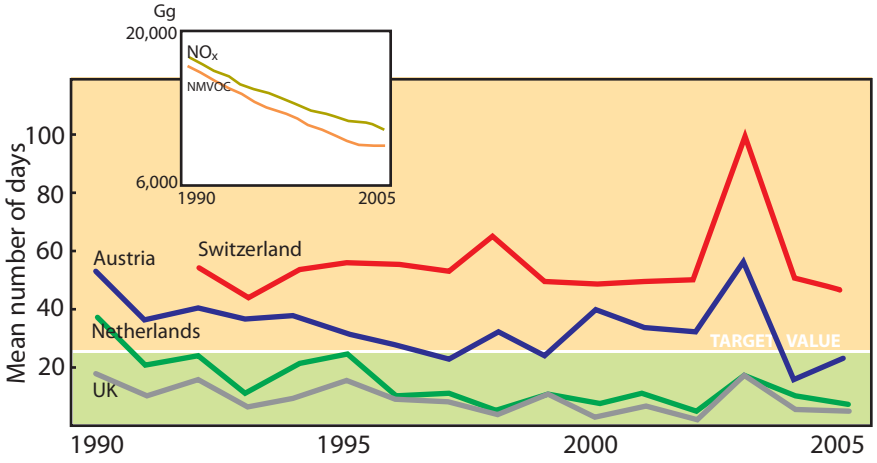
Efforts to combat European ozone levels have so far achieved only limited success, according to a recent report from the European Environment Agency (EEA). Although overall European emissions of the air pollutants that lead to ozone formation have been gradually lowered since 1990, ozone levels remain largely unchanged in many countries.

The EEA study explores the reasons for this apparent contradiction, using data from the European air quality database, AirBase, and computer models to investigate ground-level ozone formation in Europe.

Ground-level ozone is among the most harmful air pollutants in Europe today. Elevated ozone levels cause health problems, premature deaths, reduced agricultural crop yields, changes in ecosystem species composition and damage to physical infrastructure and cultural heritage. Ozone is also an important greenhouse gas, ranked third behind carbon dioxide and methane.

Ozone (O_3) is not directly emitted into the atmosphere – it is formed in complex photochemical reactions from ozone precursor gases, namely nitrogen oxides (NOx), volatile organic compounds (VOCs) and carbon monoxide (CO). Moreover, ozone formation depends strongly on meteorological conditions, such as solar intensity and temperature.

Based on emission statistics, anthropogenic emissions of ozone precursor gases were reduced by 37 per cent across the EEA-32 countries between 1990 and 2006. However, during the same time period, population exposure to ozone levels above the target value set in the EU legislation for protection of human health did not decrease. Short-term peaks in ozone concentrations reportedly dropped in the first part of the 1990s, while between 1997 and 2006 there was a year-on-year increase in daily 8-hour maximum concentration at most monitoring stations.



The number of days with ozone levels exceeding 120 µg/m³ in four European countries 1990-2005. The small inserted graph shows the emissions of ozone precursors in the EU27 over the same period. (NMVOC = non-methane volatile organic compounds).

While emission statistics show a steady decline in overall European anthropogenic emissions of NOx and VOCs, the reductions were largest during the early years both in absolute and relative terms. From 1990 to 1995 the total emissions of NOx and VOCs dropped 17 and 19 per cent, respectively, whereas during 2000–2005 the cuts were 11 and 12 per cent.

There are also large differences between the individual countries. Some countries, such as Spain, Greece, Portugal and Austria, even increased their NOx emissions, whereas others, such as Germany, Italy, Sweden, and the United Kingdom, cut their emissions of both NOx and VOCs by about 40-60 per cent.

Key findings of the study:

- Variations in weather conditions have a significant impact on ozone levels. Discerning the effect of reduced ozone precursor emissions therefore requires data from stable monitoring networks covering a long period of time. Unfortunately, extended time series data are generally unavailable, particularly in southern Europe where ozone pollution is a major problem.
- Significant uncertainties exist regarding the magnitude and distribution of intercontinental inflows of ozone and its precursors, and the size and distribution of isoprene emissions from plants.
- The importance of meteorological conditions in ozone formation suggests that predicted changes in climate could also lead to increased ground-level ozone in many regions of Europe.
- Ground-level ozone has become a hemispheric or even global air pollution and climate change problem. Ozone abatement should be integrated into local, regional and global strategies and measures that simultaneously address emissions of air pollutants and greenhouse gases.

Christer Ågren

The EEA report "Assessment of ground-level ozone in EEA member countries, with a focus on long-term trends", EEA Technical report No 7/2009, can be downloaded from: *www.eea.europa.eu/publications*

Pollution treaty to be revised

A revised Gothenburg protocol is expected to include new national emission ceilings for 2020.

Preparations are ongoing under the Convention on Long-Range Transboundary Air Pollution (CLRTAP) to update and revise the 1999 protocol to abate acidification, eutrophication and ground-level ozone, also known as the Gothenburg protocol.

The protocol sets national emission ceilings (NECs) for four major air pollutants – sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia – to be achieved by 2010 and not to be exceeded thereafter. In the EU, the 2001 national emission ceilings directive is the main instrument for implementing the treaty, complemented by a series of source-specific legislation, such as the large combustion plants directive and vehicle emission standards.

So far the protocol has been ratified by 22 European countries, and by the European Union, the United States and Canada.

Through technical annexes, the protocol also sets emission limit values for a number of specified sources, such as large combustion plants, industries and motor vehicles.

Meeting in Geneva in September, the Convention's negotiation group (the Working Group on Strategies and Review) continued its discussions on the revision of the protocol, including the technical annexes.

A revised protocol is expected to include more stringent national emission ceilings to be achieved by 2020. The possibility of adding so-called aspirational emission reduction targets for 2050 has been discussed, although such targets would most likely be non-binding.

It is expected that emissions of particulate matter (PM) – most probably as $PM_{2.5}$ – will be added to the list of pollutants covered by a revised protocol, but it is still uncertain if overall national PM emissions will be regulated through NECs or by some form of percentage reduction targets. It appears quite clear, however, that source-specific emission limits for PM will be added to the technical annexes.

Various options to introduce a larger degree of flexibility into the protocol requirements are also on the agenda of the Working Group. This was requested by the Convention's Executive Body, in order to promote ratifications by countries in Eastern Europe, Caucasus and Central Asia (EECCA) and South-Eastern Europe (SEE). So far very few of these countries have ratified the Gothenburg protocol.

The Convention's Executive Body is to meet in mid-December. The intention is to have a revised protocol finalised by December 2010.

For more information, see the Convention's web site: *www.unece.org/env/lrtap/welcome.html*

Japan aims for 25 per cent greenhose gas cut

Japan's newly elected prime minister Yukio Hatoyama has announced that Japan will aim for a 25-per-cent cut in national greenhouse gas emissions by 2020, from the base year 1990. He added that the target, which is much more ambitious than the outgoing government's, was dependent on other nations agreeing ambitious targets at December's climate talks in Copenhagen.

The new government envisages the reductions will be achieved by bringing in emissions trading, renovating housing, subsidising renewable energy and introducing low-energy technologies in cars.

RECENT PUBLICATIONS

Assessment of the Impacts of Global Change on Regional US Air Quality: *A Synthesis of Climate Change Impacts on Ground-Level Ozone* (April 2009).

According to the report, climate change has the potential to increase emissions of ozone precursors, to produce significant increases in ground-level ozone concentrations in many regions, particularly for the highest-ozone events, and to lengthen the ozone season.

Published by the US Environmental Protection Agency: *cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=203459*

Long-Term Exposure to Air Pollution: Effect on Mortality (July 2009).

The draft report summarises new evidence and puts forward quantitative estimates of the impact of the effects of long-term exposure to PM pollution on mortality. The evidence for the effects of long-term exposure to sulphur dioxide, nitrogen dioxide, carbon monoxide and ozone on mortality is also discussed but is felt to be weaker than that regarding particles.

Published by the United Kingdom Committee on the Medical Effects of Air Pollutants (COMEAP): *www.advisorybodies.doh.gov.uk/comeap/longtermsffectsmort2007.htm*

Managing the European Nitrogen Problem: *A proposed strategy for integration of European research on the multiple effects of reactive nitrogen* (July 2009).

24-page report aiming to stimulate debate in EU-countries, international conventions and in the scientific community. Feedback requested.

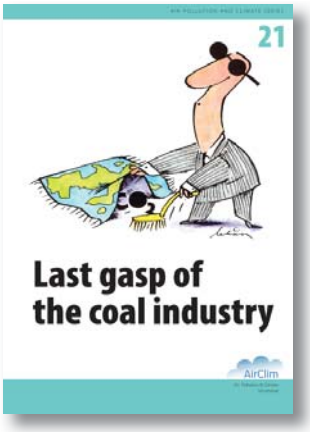
Published by the Centre for Ecology & Hydrology and the Partnership for European Environmental Research: www.clrtap-tfrn.org/european-research-strategy

Arctic Climate Feedbacks: Global Implications (September 2009).

Warming in the Arctic could lead to flooding affecting one quarter of the world's population, substantial increases in greenhouse gas emissions from massive carbon pools, and extreme global weather changes.

Report published by WWF: *www.panda.org/what_we_do/where_we_work/arctic/?173262/Warming-Arctics-global-impacts-outstrip-predictions*

Recent publications from the Secretariat

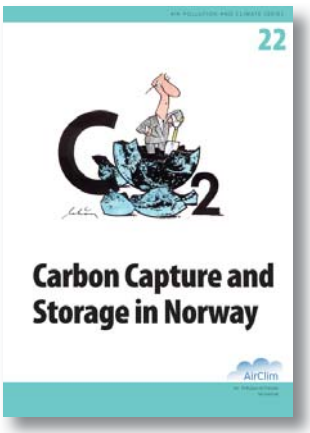


Last Gasp of the Coal Industry

By Gabriela von Goerne and Fredrik Lundberg, October 2008.

By employing carbon capture and storage (CCS) we can continue to use fossil fuels and at the same time greatly reduce carbon dioxide emissions. This frequently painted picture sounds almost too good to be true, and that is probably the case.

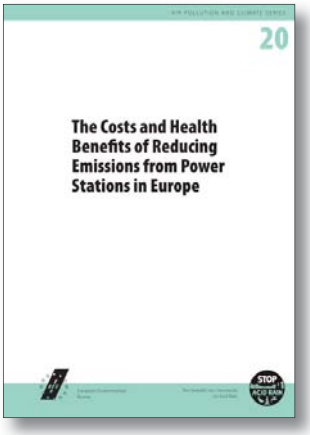
This report takes a look behind the bright vision of CCS given by proponents of this technology. It is not intended to damn CCS but is an appeal for wise decision-making.



Carbon Capture and Storage in Norway

By Tore Braend, October 2008. Strong economic and political motives, combined with a partly positive and partly silent NGO community, has contributed strongly to the present powerful commitment towards the use of CCS in Norway.

The overall effect of this commitment has been a negative impact on efforts to reduce emissions of greenhouse gases in other sectors, especially the transport sector, where emissions are growing fastest.



The Costs and Health Benefits of Reducing Emissions from Power Stations in Europe

By Mark Barrett, UCL, and Mike Holland, EMRC, April 2008.

According to this study, application of advanced emission control technologies to the 100 most polluting plants in the EU27 would cut total EU27 emissions of SO_2 by approximately 40 per cent and emissions of NOx by 10 per cent. The average benefit-to-cost ratio for measures at the 100 most polluting plants in Europe is 3.4, i.e. the estimated health benefits are 3.4 times bigger than the estimated emission control costs.

How to order

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

Same, same but different...

Since 1 October 2008 the Swedish NGO Secretariat on Acid Rain has a new name.

From now on we are the **Air Pollution & Climate Secretariat.**

Please note our new web address, **www.airclim.org**, and new mail addresses: *info, christer.agren, reinhold.pape, acidnews*; all followed by *@airclim.org*

Coming events

Intermediate Climate Policies – The contribution of air pollution policies in terms of climate stabilisation and co-control. Göteborg, Sweden, 19–21 October 2009. Information: *www.naturvardsverket.se/en/In-English/Menu/GlobalMenu/Calendar-of-events/Intermediate-climate-policies/*

EU Environment Council. 21 October, 2009. Information: *www.consilium.europa.eu/*

Carbon Footprinting – Delivering Business Benefits. London, UK, 29 October 2009. *Information*: *www.carbonfootprintingevent.com*

UN FCCC Fourth preparatory session for Copenhagen. Barcelona, Spain, 2–6 November 2009. Information: *unfccc.int/*

Air Quality Planning – Measures against Particulate Matter and Nitrogen Oxides. Augsburg, Germany, 19 November 2009. Information: *www.lfu.bayern.de/*

UN FCCC COP 15 and COP/MOP 5. Copenhagen, Denmark, 7–18 December 2009. Information:*unfccc.int/*

GLOBAL DAY OF ACTION – International Demonstrations on Climate Change. 12 December 2009. Information: */ www.globalclimatecampaign.org/*

CLRTAP Executive Body. Geneva, Switzerland, 14–18 December 2009. Information: *www.unece.org/env/lrtap/welcome.html*

EU Environment Council. 22 December, 2009. Information*: www.consilium.europa.eu/*

Fourth International Conference on Plants & Environmental Pollution (ICPEP-4). Lucknow, India, 7–10 February 2010. Information: *isebindia.com/*

GreenPort 2010. Stockholm, Sweden, 24–25 February 2010. Information*: www.greenport.net/*

CLRTAP Working Group on Strategies and Review. Geneva, Switzerland, 12–16 April 2010. Information: *www.unece.org/env/lrtap/welcome.html*

Transport and Air Pollution – 18th International Symposium. Zürich, Switzerland, 18–19 May 2010. Information: *ettap09.inrets.fr*