

Countries taken to court over air quality breaches

If EU countries do not urgently address their air pollution problems, the European Court of Justice can impose fines amounting to millions of euro.

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Europe still building new coal power stations

Several countries in Europe have recently built or are planning to build new coal power stations. Examples from Eastern Europe are presented here.

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Swedes harmed by air pollution

Every year 7600 people in Sweden die prematurely due to nitrogen dioxide and particulate matter, with an annual cost to society of at least 5.3 billion euro.

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Ammonia emissions keep on rising

Five EU countries breached their national emission ceilings for ammonia in 2016 and total emissions have now increased by two per cent over three years.

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A smorgasbord of sustainable solutions

Environmentally aware public procurement and the inclusion of sustainability in dietary guidelines are measures already taken in the transition towards a sustainable food system.

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Solar radiation management

SRM is perilous, as the consequences of intervening in a highly complex system are unpredictable.

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Member states to set the bottom floor

The climate and environment are central objectives in the new CAP proposal, but more flexibility for member states risks undermining delivery on the ground.

On 1 June the Commission presented their proposal for a Common Agricultural Policy (CAP) 2021–2027. The agricultural commissioner Phil Hogan presented it as “delivering genuine subsidiarity for member states; ensuring a more resilient agricultural sector in Europe; and increasing the environmental and climate ambition of the policy”.

Environmental organisations responded with criticism. Bérénice Dupeux from EEB said that the “proposal remains an empty

shell, with payments neither linked to environmentally friendly farm methods or actual environmental improvements”. Greenpeace EU agriculture policy director Marco Contiero commented along the same lines, “the Commission’s plans offer almost no protection for health, the environment and climate”.

So, what is behind Hogan’s claim of higher ambitions for the climate and environment?

Acid News

A newsletter from the Air Pollution & Climate Secretariat, the primary aim of which is to provide information on air pollution and its effects on health and the environment.

Anyone interested in these matters is invited to contact the Secretariat. All requests for information or material will be dealt with to the best of our ability. Acid News is available free of charge.

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

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The Air Pollution and Climate Secretariat

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

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

In furtherance of these aims, the Secretariat:

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

Editorial

“Limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society.” This is the main message of the IPCC report released on 8 October. They also conclude “that we are already seeing the consequences of 1°C of global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice, among other changes”.

For anyone who has followed the statements of the IPCC over recent decades this came as no surprise. With every new publication the message of certainty and urgency has become clearer.

But when you work with climate issues every day your mind eventually gets a bit numb and you have to stop and reflect over what the words actually mean. I repeat to myself “unprecedented changes in all aspects of society”. This means that all governments should right now put everything else aside and focus on one major task for the next decade – to make our world fossil-free.

We don’t have the time for quarrels about immigration laws, tax levels, healthcare systems and trade agreements until we have agreed on a serious plan for a new fossil-free economy.

Unfortunately, we don’t see European leaders acting as if there is an emergency. New coal power plants are still being planned and built in Europe (see p. 12). The proposed common agricultural policy (CAP) allows member states to continue with business as usual (see front page). There is still no effective regulation to reduce emissions from aviation and shipping (see p. 10).

It is however important to remember we haven’t reached 1.5°C of warming yet. The amount of greenhouse gases needed to cause that kind of warming have not been released yet. The message from the

IPCC is that – there is still hope. But not that kind of comfortable hope, where we can sit back in the office chair and relax in the knowledge of a happy ending. The only hope we can put our trust in is the hope of our own actions.

“The only hope we can put our trust in is the hope of our own actions”

Every one of us has a responsibility to free ourselves from numbness and passivity. Just doing a little bit is not enough anymore.

In the last week of October, the “Ende-Gelände” movement in Germany will occupy lignite mines in Rhine area. Right now, this seems to be the only reasonable thing

to do. Occupy every coal mine, every oil rig and every other fossil fuel extraction unit there is and give a clear message: leave it in ground.

If you cannot stand in front of the excavators, act on whatever you have power over. Be the uncomfortable person at the next Monday morning work meeting, at the kitchen table and at the local soccer club, who pushes the fossil-free transition as far as you can. Every institution, company, organisation and home needs to become fossil-free within the next decade. Put solar panels on the roof, demand fossil-free pension funds and take the train on your next vacation. The politicians must add their weight, but at the moment they are not prepared to lead.

We need to see great deeds from the masses to accomplish unprecedented system change!

Kajsa Pira

Ende Gelände will take place on 25-29 October:
<https://www.ende-gelaende.org>

Six countries taken to court over air quality breaches

If EU countries do not urgently address their air pollution problems, the European Court of Justice can impose fines amounting to millions of euro.

On 17 May the European Commission announced that it has referred six EU governments – France, Germany, the UK, Hungary, Italy and Romania – to the European Court of Justice (ECJ) for failing to take adequate measures to tackle air pollution.

The decision follows an ultimatum given in January to nine countries to produce credible plans to effectively tackle illegal levels of the air pollutants nitrogen dioxide (NO₂) and particulate matter (PM₁₀) (see AN 1/18, pp 14–15).

France, Germany and the UK have breached the binding air quality limit values on NO₂ and failed to take appropriate measures to keep exceedance periods as short as possible, the Commission said, while Hungary, Italy and Romania were referred to court over persistently high levels of PM₁₀. The limits set out under EU legislation on ambient air quality (Directive 2008/50/EC) had to be met in 2010 and 2005 respectively.

On 30 January, Environment Commissioner Karmenu Vella convened nine member states for ministerial meetings in Brussels in an effort to find solutions to address their serious air pollution problems. The six countries now referred to court did not, according to the Commission, present credible, effective and timely measures to reduce pollution, within the agreed limits and as soon as possible, as required under EU law.

As regards the remaining three countries – the Czech Republic, Slovakia and Spain – the Commission concluded that the measures being put in place or planned appear to be able to tackle the identified gaps, if correctly implemented. The Commission said that it will continue to closely monitor the implementation of the measures as well as their effectiveness in redressing the situation as soon as possible.

In all cases of exceedance of limit values

set by the EU ambient air quality directive, member states are required to adopt air quality plans containing measures that ensure that the exceedance period is kept as short as possible.

Environmental groups welcomed the Commission's action. Margherita Tolotto, air quality policy officer at the European Environmental Bureau, said: "Today's announcement should surprise no one, the countries being sent to court have had too many final warnings."

However, she questioned why some governments but not others have been sent to court and said that: "Citizens deserve to know what is being done to protect them from polluted air. The process behind these infringement actions should be far more transparent."

Regarding NO₂, there are currently thirteen infringement cases pending against Austria, Belgium, the Czech Republic, Germany, Denmark, France, Spain, Hungary, Italy, Luxembourg, Poland, Portugal, and the United Kingdom.

Moreover, there are sixteen infringement cases for PM₁₀ pending against Belgium, Bulgaria, the Czech Republic,

Germany, Greece, Spain, France, Hungary, Italy, Latvia, Portugal, Poland, Romania, Sweden, Slovakia, and Slovenia. Two of these countries, Bulgaria and Poland, have already been found in breach of the PM₁₀ limits in judgements by the ECJ on 5 April 2017 and 22 February 2018, respectively.

To help member states fight air pollution and improve air quality, the Commission has published a Communication entitled "A Europe that protects: Clean air for all", which outlines a number of available measures as well as sources of EU funding.

Christer Ågren

Press release by the European Commission, 17 May 2018 http://europa.eu/rapid/press-release_IP-18-3450_en.htm

Press release by the EEB, 17 May 2018 <http://eeb.org/eu-air-quality-limits-breached-on-a-continental-scale-six-countries-sent-to-ecj/>

Commission Communication "A Europe that protects: Clean air for all" http://ec.europa.eu/environment/air/pdf/clean_air_for_all.pdf

Commission Factsheet "Clean air for all" https://ec.europa.eu/info/sites/info/files/clean_air_for_all_factsheet.pdf

Hungary is one of six countries referred to the European Court of Justice because their governments have not done enough to improve air quality.



Member states to set the bottom floor

Continued from front page

First, the striking theme of the new proposal is increased flexibility for member states. Member states are expected to present their own Strategic CAP Plans with various components from a loose framework (see AN2/18). This offers an opportunity for member states that wish to increase their environmental ambition to do so. However, it also means that member states that do not have the environment particularly high on their agenda can design a national CAP with quite low environmental ambitions. How low the bottom floor is in the proposal is difficult to determine; this will be decided to quite a degree by the interpretation of details and how strict the Commission will be in their review of the national plans.

The green architecture of the proposed CAP consists of three building blocks: enhanced conditionality in pillar I, eco schemes in pillar I and climate/environmental schemes in pillar II. All three are compulsory for member states, but only the first one is compulsory for farmers.

The enhanced conditionality is what was previously called cross-compliance and sets minimum standards that all farms that receive direct payments under pillar I must comply with. The word “enhanced” refers to five new Good Agricultural and Environmental Conditions (GAECs). Three of these can easily be related to the practices included in the scrapped greening mechanism: GAEC 1 – maintenance of permanent pasture, GAEC 8 – crop rotation (to replace crop diversification), and GAEC 9 – maintenance of non-productive areas (to replace Ecological Focus Areas).

The other change is the addition of new requirements: GAEC 2 – to protect carbon-rich soils, GAEC 5 – to make compulsory the use of the new Farm Sustainability Tool for Nutrients, and GAEC 10 – a ban on converting grassland in Natura 2000 sites. GAEC 5 means that the need to have a nutrient management plan is extended to all agricultural land, not just land in Nitrate Vulnerable Zones, as is currently the case.

What environmental benefits these new requirements will entail depends on how they are more precisely defined by

the member states. Previous evaluations of the cross-compliance mechanism have shown that interpretations into national standards can be very lax.

Eco-schemes are a new structure under pillar I. They are obligatory for member states, but they are not ring-fenced by provisions such as a minimum level of funding. According to the Commission they “will have to address the CAP environment and climate objectives in ways that complement the other relevant tools available and go beyond what is already requested under the conditionality requirements”. They could either be payments by hectare, as a bonus to the direct payments or as compensation for single implementations. The types of measures that are expected to occur under this scheme are similar to what have previously been seen under the Rural Development Programmes in pillar II. Important differences are however that the level must not be related to the cost for the farmer to carry them out (at least if they are area payments) and they will not need to be co-financed by the member states like the pillar II schemes.

Agri-environmental-climate measures (AECMs) will still be around as an obligatory element of the member states’ Rural Development programme under pillar II. One concern is that the money for Pillar II will decrease during the next CAP period and of course threaten the funds allocated to AECMs. However, if member states wish to be ambitious the Commission offers several solutions in their proposal. As with the present CAP it is possible for member states to move 15 per cent of the funding from one pillar to the other. In addition to this they are allowed to move an extra 15 per cent from pillar I to pillar II for interventions that address environmental and climate objectives. They can also top up pillar II with their own funding. Another option is to increase their co-funding of pillar II.

For member states less concerned with the environment the Commission has designed three mechanisms to safeguard a lowest level of ambition: a minimum of

40 per cent spending on climate under the CAP, a minimum of 30 per cent spending on AECMs under pillar II and a no-backsliding requirement.

The 40 per cent spending on climate action can be seen as a bookkeeping exercise, where “climate action” is interpreted broadly and weighted accordingly:

- 40% of the area payments under pillar I (since they are under conditionality)
- 100% for expenditure under eco-schemes
- 100% for expenditure for AECMs
- 40% for expenditure for natural or other area-specific constraints.

This could put some constraints on member states that want to prioritise coupled payments under pillar I and investment support under pillar II.

A requirement for a minimum of 30 per cent spending on AECMs under pillar II exists in the present CAP. What is new in the proposal is that expenditure on areas of natural constraints and areas with other specific constraints is no longer included. This should protect the present funding for environmental measures even if pillar II has shrunk.

Finally, there is article 92 in the Strategic Plan, which says that member states “shall aim to make ... a greater overall contribution to the achievement of the specific environmental- and climate-related objectives” and they should explain in their strategic plans “how they intend to achieve the greater overall contribution” to those objectives.

The weakness of this phrasing is that member states only “shall aim”, while the term “contribution”, as explained by DG Agri officials, does not refer to monetary amounts or expenditure. The value of this article, if not strengthened, again depends on how strictly the Commission assesses





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the countries' qualitative explanations.

Whether the proposal will be watered down or strengthened is now up to Council and the European Parliament. When the agricultural ministers met in mid-July they were more concerned that the "enhanced conditionality" would add to bureaucracy than they were about discussing its capacity to deliver environmental results on the ground.

Earlier in July the European Parliament appointed three rapporteurs. The ambition is to have a first reading before the European Union elections in May 2019. For the first time the Parliament's environment committee has been given shared competence, as an "associated committee", over the environmental content in the CAP.

Kajsa Pira

The content of this article is to a large extent based on two articles by Allan Mathews:

<http://capreform.eu/the-greening-architecture-in-the-new-cap/>

<http://capreform.eu/the-article-92-commitment-to-increased-ambition-with-regard-to-environmental-and-climate-related-objectives/>

The Commission's press release, 1 June 2018:

http://europa.eu/rapid/press-release_IP-18-3985_en.htm

Coal will be squeezed out by renewables

Prices of green electricity and batteries have fallen so sharply that projections for 85–90% renewables by 2035 look "ludicrously conservative", according to the energy coalition ETC.

Nearly every week over the past year new reports and news from business organisations show renewable energy is becoming more and more cost-effective. Here are two examples: Bloomberg reports that coal will be increasingly squeezed out of the power generation market over the next three decades as the cost of renewables plunges and technology improves the flexibility of grids globally. The Bloomberg New Energy Finance study estimated some \$11.5 trillion of investment will go into electricity generation between now and 2050. Of that, 85 per cent, or \$9.8 billion, will go into wind, solar and other zero-emissions technologies. Better batteries, which allow grid managers to store power for times when it's neither breezy nor sunny, will allow utilities to take advantage of plunging costs for solar panels and wind turbines.

Euractive recently reported on the conclusions from the Energy Transitions Commission (ETC), a coalition of leading organisations from the worlds of business, energy and finance. Prices of green electricity and batteries have fallen so sharply that even projections for an 85–90-per cent renewable energy system in 2035 now look "ludicrously conservative", said Lord Adair Turner, the former Chairman of the UK Financial Services Authority, who now chairs the Energy Transitions Commission. Turner said

even the most optimistic projections for renewables made in the past had been beaten by the actual costs of deployment on the ground. Taking conservative assumptions on future trends, he said the ETC had come to the conclusion that a 100-per-cent renewable energy system was now clearly within reach – and probably sooner than we think. "We are pretty confident that in 10 or 15 years...you would be able to do a near-total renewable system – 85 or 90 per cent – based on intermittent renewables," Turner said, adding: "We said 2035 but this is probably ludicrously conservative." Further price decreases can be expected, Turner said, predicting an auction for solar power at \$1 cent per kilowatt hour in the near future. The fall in price of batteries has also been impressive, Turner pointed out, saying the cost of storage per kilowatt had gone down 70 per cent between 2010 and 2016.

Compiled by Reinhold Pape from articles by Bloomberg and Euractive

<https://www.bloomberg.com/news/articles/2018-06-19/coal-is-being-squeezed-out-of-power-industry-by-cheap-renewables>

<https://www.euractiv.com/section/electricity/news/near-total-renewable-energy-system-within-reach-lord-adair-turner/>

<http://www.energy-transitions.org/>



EU “Clean Air Outlook” up to 2030

The annual benefits of additional measures needed to achieve the 2030 national emissions ceilings are estimated at €13–58 billion, up to 84 times higher than the estimated costs.

Requirements to reduce air pollutant emissions established in the new National Emission Ceilings (NEC) directive could be achieved cost-effectively, at lower costs and with higher health benefits than initially thought, according to a new analysis by the European Commission.

Published on 7 June 2018, the first EU Clean Air Outlook report looks at the prospects for EU air quality up to 2030. It follows from the 2013 Clean Air Programme proposal for a regular update of the air quality situation in the EU and builds on several studies prepared by the Commission's consultant, IIASA.

Commenting on the Clean Air Outlook report, EU Environment Commissioner Karmenu Vella said: “While ensuring clean air for our citizens requires urgent action from member states now, action to reduce air pollution will also pay off in the long run. This report shows that,

at the EU level, we have the right policies working in the right direction, and that multiple benefits are possible. Now we have to make sure that these policies are fully implemented. For only one euro per citizen per year, thousands of premature deaths due to poor air quality could be prevented by 2030.”

The new NEC directive requires each member country to cut emissions of five major air pollutants in two steps, by 2020 and by 2030. The pollutants covered are sulphur dioxide (SO₂), nitrogen oxides (NO_x), non-methane volatile organic compounds (VOC), ammonia (NH₃) and particulate matter (PM_{2.5}). For the EU as a whole for 2030 these reductions add up to 79% for SO₂, 63% for NO_x, 49% for PM_{2.5}, 40% for VOC and 19% for NH₃, as compared to the emission levels in the base year, 2005. Country-by-country figures are shown in Table 1.

In the new reports, IIASA analyses the joint effect of new EU measures put in place since 2014 to reduce air pollutant emissions from

different sources (e.g. medium combustion plants, non-road mobile machinery and domestic solid-fuel combustion) and changes resulting from the updated EU energy and climate policy. They also account for improvements made over the last few years in the national emission inventories.

Based on the above-mentioned information, two new baseline emission scenarios were produced, one that does not account for the EU's climate and energy policy (REF) and one that includes this policy (CEP). The resulting emissions in 2030 under these baseline scenarios show whether countries are on track to meet the 2030 emission reduction requirements (ERR) of the NEC directive or not. In cases where the resulting national emission ceilings are not expected to be met, IIASA subsequently identified the least-cost measures needed in each country to meet their ceilings, producing so-called optimised scenarios. Table 2 shows percentage changes in total EU-28 emissions for the various scenarios (country-by-country figures can be found in the report).

It was shown that for both scenarios only a handful of countries will have to take additional measures to meet their emission ceilings for SO₂ and NO_x. On the other hand, for VOCs, PM_{2.5} and especially for NH₃, the

A full implementation of the NEC directive requirements would reduce premature deaths by 200,000 annually by 2030.



Table 1: Total EU emissions in 2005, the 2030 emission reduction requirements (ERRs) of the NEC directive, and the resulting emission ceilings in 2030, as estimated by IIASA's GAINS model (kilotons).

	GAINS estimates for 2005 (kilotons)					Emission reduction requirements (ERRs)					Resulting emission ceilings for 2030 (kilotons)				
	SO ₂	NO _x	PM _{2.5}	NH ₃	VOC	SO ₂	NO _x	PM _{2.5}	NH ₃	VOC	SO ₂	NO _x	PM _{2.5}	NH ₃	VOC
Austria	26	229	21	66	145	41%	69%	46%	12%	36%	16	71	11	58	93
Belgium	143	304	38	69	145	66%	59%	39%	13%	35%	49	125	23	60	94
Bulgaria	778	178	38	40	128	88%	58%	41%	12%	42%	93	75	22	35	74
Croatia	59	79	42	38	97	83%	57%	55%	25%	48%	10	34	19	29	50
Cyprus	38	22	3	6	11	93%	55%	70%	20%	50%	3	10	1	5	6
Czech Rep.	207	278	38	84	207	66%	64%	60%	22%	50%	70	100	15	66	104
Denmark	26	180	27	77	110	59%	68%	55%	24%	37%	11	57	12	58	70
Estonia	76	40	15	10	29	68%	30%	41%	1%	28%	24	28	9	10	21
Finland	69	183	37	39	126	34%	47%	34%	20%	48%	46	97	24	31	66
France	449	1381	260	753	1203	77%	69%	57%	13%	52%	103	428	112	655	578
Germany	471	1431	125	671	1157	58%	65%	43%	29%	28%	198	501	72	477	833
Greece	541	403	59	58	263	88%	55%	50%	10%	62%	65	181	30	52	100
Hungary	42	156	42	79	122	73%	66%	55%	32%	58%	11	53	19	54	51
Ireland	74	139	18	103	67	85%	69%	41%	5%	32%	11	43	11	98	46
Italy	410	1192	168	434	1206	71%	65%	40%	16%	46%	119	417	101	364	651
Latvia	9	41	22	17	48	46%	34%	43%	1%	38%	5	27	13	17	29
Lithuania	31	50	20	33	69	60%	51%	36%	10%	47%	12	25	13	30	37
Luxembourg	2	56	3	6	11	50%	83%	40%	22%	42%	1	10	2	5	7
Malta	11	9	1	2	4	95%	79%	50%	24%	27%	1	2	0	1	3
Netherlands	65	359	23	152	175	53%	61%	45%	21%	15%	30	140	12	120	149
Poland	1170	784	248	314	587	70%	39%	58%	17%	26%	351	478	104	260	434
Portugal	178	245	58	53	197	83%	63%	53%	15%	38%	30	91	27	45	122
Romania	609	333	136	194	347	88%	60%	58%	25%	45%	73	133	57	145	191
Slovakia	92	88	40	32	76	82%	50%	49%	30%	32%	17	44	20	23	51
Slovenia	41	50	12	20	43	92%	65%	60%	15%	53%	3	18	5	17	20
Spain	1274	1468	135	500	799	88%	62%	50%	16%	39%	153	558	68	420	487
Sweden	36	195	30	63	202	22%	66%	19%	17%	36%	28	66	25	53	129
UK	707	1541	119	314	1061	88%	73%	46%	16%	39%	85	416	64	264	647
EU-28	7634	11415	1776	4228	8635	79%	63%	49%	19%	40%	1618	4228	889	3451	5142

analysis showed that additional measures would be needed for many countries to meet their emission ceilings for these pollutants.

However, there were also cases where full implementation of currently existing legislation will lead to “overachievement” of the emission ceilings, i.e. the baseline scenarios alone reduce national emissions beyond the minimum requirements of the NEC directive, thus providing additional health and environmental improvements. The reason for this is primarily that some measures introduced to control one specific pollutant also deliver emission reductions in other pollutants. One example of this is the ban on agricultural waste burning, which simultaneously reduces emissions of PM_{2.5}, VOCs and NH₃.

After full implementation of the emission reduction requirements of the NEC direc-

tive, the share of EU population exposed to PM_{2.5} concentrations above the World Health Organization's (WHO) guideline is expected to drop significantly, from 88 per cent in 2005 to around 13 per cent in 2030.

Cases of premature deaths due to excessive levels of PM_{2.5} and ozone would come down by 54 per cent, from 418,000 in 2005 to 194,000 in 2030.

But less improvement is expected for ecosystems, especially for impacts on biodiversity resulting from an oversupply of airborne nitrogen compounds. In 2005 around 78 per cent (430,000 km²) of the EU's protected ecosystem area was

Table 2. Total EU emissions in 2005 (kilotons); National emission ceilings in 2030; Changes in emissions by 2030 under baseline and optimised scenarios, as estimated by IIASA's GAINS model.

	2005	2030 baseline		2030 NECD	2030 optimised	
		REF	CEP		REF	CEP
SO ₂	7634	-78%	-80%	-79% (1618)	-80%	-81%
NO _x	11415	-65%	-68%	-63% (4228)	-66%	-68%
VOC	8635	-42%	-42%	-40% (5142)	-45%	-46%
NH ₃	4228	-5%	-5%	-19% (3451)	-19%	-19%
PM _{2.5}	1776	-51%	-53%	-49% (889)	-56%	-58%

exposed to excess nitrogen deposition. By 2030, this figure is expected to come down only by approximately one quarter, to 320,000 km² which equals 58 per cent of the Natura2000 nature protection areas. The main reason for this is the directive's significantly lower ambition level for reducing ammonia emissions from agriculture.

EU “Clean Air Outlook” up to 2030

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When the Commission presented its proposal for a revised NEC directive in 2013, the estimated annual cost in 2030 for achieving the emission ceilings was €2.2 billion. As the negotiations with the Council and Parliament resulted in an overall lowering of the ambition level, especially regarding reductions of ammonia, this estimate came down to €1.8 billion.

When taking into account the additional source legislation adopted since 2014, the remaining cost specifically attributable to additional measures needed to achieve the 2030 emission ceilings comes down to €960 million in the optimised reference scenario. As an average for the whole EU, this equals an annual cost of €1.9 per person in 2030. And by lowering the burning of fossil fuels, implementation of the EU’s climate and energy policy would further reduce the cost of the NEC directive to €540 million (€1.05 per person and year), corresponding to 0.004 per cent of the GDP.

The analysis shows that costs in 2030 for implementing already adopted air pollution legislation and measures are unevenly distributed across different economic sectors, with more than half of the total costs carried by road transport. The power sector, industry and non-road mobile machinery each carry about 13 per cent of total costs, the domestic sector about 5 per cent, and agriculture about 3 per cent.

Not surprisingly, when looking at additional action needed to achieve the 2030 emission ceilings, a series of measures in agriculture were identified as very cost-effective, including measures linked to the application of mineral fertilisers and manure management.

Total annual health costs of air pollution in 2005 have been estimated to amount to between €385 and 1099 billion in the EU. By 2030, full implementation of current legislation (the baseline scenarios) is expected to reduce these costs by more than 50 per cent.

The incremental annual benefits resulting from additional measures taken to meet the 2030 emission ceilings are valued at €13–58 billion (see Table 3).

While including estimated benefits to crops, forests, ecosystems and materials, benefits to health make up more than 95 per cent of the total monetised benefits.

A comparison between the benefits and the costs shows that even if a low health valuation is used the benefits still exceed costs by a factor of at least 17. If a higher health valuation is used instead, benefits are up to 84 times higher than the costs.

It should be noted that for various reasons some of the health benefits from less air pollution exposure were not included in this valuation. This applies, for example, to reduced damage to health from nitrogen dioxide (NO₂) exposure and impacts identified on dementia, obesity and diabetes.

Moreover, the cost-benefit analysis has been limited geographically to the EU’s 28 member countries, which means that no allowance has been made for the positive effects of reducing emissions in the EU on health and the environment in non-EU countries.

Methane, black carbon and ozone are of concern both for air quality and climate change, and the Commission noted in particular that methane is a major contributor to background ozone concentrations. Later this year the Commission’s Joint Research Centre will present a report on methane emissions and their contribution to ozone. The Commission said that it “will further assess the impact of methane emissions on achieving air policy objectives, consider measures for reducing those emissions and, where appropriate, submit a legislative proposal, based on the evidence at EU and global level.”

According to the Commission, it is now stepping up cooperation with member states to help them comply with EU clean air policy and legislation. Financial support for air pollution control measures is being provided, and clean air dialogues with member states are ongoing to share solutions towards better implementation of the air legislation. But more efforts are

Table 3. Comparison of costs and benefits for the EU of achieving the 2030 emission ceilings (million euro).

	Optimised REF scenario	Optimised CEP scenario
Median VOLY		
Benefits	16,258	12,682
Costs	960	539
Net benefits	15,298	12,143
Benefit-to-cost ratio	16.9	23.5
Mean VSL		
Benefits	58,355	45,397
Costs	960	539
Net benefits	57,395	44,858
Benefit-to-cost ratio	60.8	84.2

Note: Specifically for mortality impacts, a lower and a higher value were used, the former being based on the value of a life year lost (VOLY) and the latter on the value of a statistical life (VSL).

still needed from member states.

The Commission stresses that “there is an urgent short-term need to take decisive action to achieve the objectives of the Ambient Air Quality directives, at all governance levels,” and that in the longer term, complementary action at all these levels will be required to ensure that the EU’s long-term objectives are met.

This first Clean Air Outlook will provide the context for member states’ work in developing their National Air Pollution Control Programmes (NAPCPs) due by 1 April 2019 under the new NEC directive. The next Clean Air Outlook is foreseen for 2020 and will include the Commission’s analysis of the 2019 NAPCPs.

Christer Ågren

Sources:

- The First Clean Air Outlook. Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. COM(2018) 446 final (7 June 2018).

- Progress towards the achievement of the EU’s air quality and emissions objectives. IASA (December 2017).

- Costs, benefits and economic impacts of the EU clean air strategy and their implications on innovation and competitiveness. IASA (December 2017).

All three reports are available at: http://ec.europa.eu/environment/air/clean_air/outlook.htm

Cruise ship ranking

In its updated cruise ship ranking, German environmentalist organisation NABU (Nature And Biodiversity Conservation Union) concludes that just one newly built cruise ship, the AIDAnova, renounces the use of toxic heavy fuel oil and instead uses less-polluting liquefied natural gas (LNG). It therefore tops NABU's 2018 cruise ship ranking. All the remaining 76 checked ships, including eight out of nine vessels that are new to the market this year, continue to use dirty heavy fuel oil.

Hapag Lloyd Cruises and TUI Cruises are keeping up a little by using SCR catalysts or onshore power while in port on their new vessels. However, particulate filters to reduce harmful soot particles are not installed on these ships either.

Source: NABU, 21 August 2018. Link: <https://en.nabu.de/news/2018/25037.html>



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Five fully-electric ferries in Copenhagen

The multinational public transport company Arriva Danmark has recently contracted Damen Shipyards Group for five fully-electric ferries, to be operated for the Danish public transport agency MOVIA, in Copenhagen, as the city strives to meet its target of zero emissions in public transport in the years to come.

One of the electrified harbour buses that soon will be in traffic in the Danish capital.



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Under the 12-year contract, the vessels will be fully electric and zero emissions, with almost zero noise. In order for the vessels to be able to fit into the existing framework, Damen has developed a design with a capacity for 80 passengers, tailored so that the vessels can dock bow-first at the existing jetties, which will be equipped with fast-charging points.

Source: Safety4Sea, 16 July 2018.

LNG wrong course

Switching to liquefied natural gas (LNG) is a costly and ineffective way of reducing greenhouse gas emissions from shipping, according to a new study commissioned by Transport & Environment. While LNG could help the ship industry meet its targets for reducing air pollution by sulphur, nitrogen oxides and fine particles, it would only reduce shipping's GHGs by a maximum of 10 per cent by 2050.

The study warns that current and future investments in LNG infrastructure made in anticipation of a large LNG market for shipping – and also required under the EU's 2014 Alternative Fuels Infrastructure Directive – are likely to

become stranded assets by 2050. T&E said that the EU needs to stop mandating LNG infrastructure in European ports and instead it should back future-proof technologies that will deliver the needed decarbonisation. This means switching to zero-emission technologies like hydrogen, ammonia and electric propulsion.

Sources: T&E News, 25 June; Ends Europe Daily, 26 June 2018. The study: <https://www.transportenvironment.org/publications/lng-marine-fuel-eu>



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Norway heading for zero-emission ships

Norway has set its sights on creating the world's first zero emissions control area (ZECA). A resolution adopted by the Norwegian Parliament on 3 May seeks to halt emissions from cruise ships and ferries in the Norwegian world heritage fjords "as soon as technically possible and no later than 2026".

"For the first time in the world there is a requirement for emission-free sailing in the fjords and their harbours. Norway has long been a world leader in emission-free ferries based on sound political decisions on zero-emission requirements. Now the country is taking a step further in the maritime green shift, that has global

repercussions," said Marius Holm, head of the environmental foundation ZERO. "At the national level, this will mean a welcome development towards emission-free solutions on many tourist ships, a significant decrease in greenhouse gas emissions and a halt to harmful local air pollution."

Source: Ship & Bunker News, 4 May 2018.



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Lessons from aviation's first foray into market-based measures

International Civil Aviation Organization landed on the cheapest, most contentious, and finally outdated policy instrument out there – offsetting.

The Paris Agreement mandates deep decarbonisation of all sectors that rely on fossil fuels out to 2050, giving us a limited amount of greenhouse gases that we can emit by that year. Aviation and shipping, if their projected growth comes to pass, would take up almost 40 per cent of the allowable emissions if we are to limit global warming. These two sectors have severely delayed their action on climate change, in part because of their isolation within specialised UN agencies with heavy industrial representation; this insulates these sectors from wider climate discussions.

These agencies, the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO), intend to use market-based measures (MBMs), known generally as carbon pricing, as a way to make polluting the air more expensive and decrease emissions. The most straightforward method is a tax on fuel. More complex measures require the trading of credits or permits that allow a plane or ship to pollute for a price. These trading options require perfect compatibility with the trading rules currently being negotiated under Article 6 of the Paris Agreement, which aim to prevent trades from being improperly accounted for more than once.

Of the two sectors, the aviation sector has moved first, with the ICAO deciding on the most controversial of trading options – offsetting – through the establishment of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) in 2016.

CORSIA relies on the purchase of carbon offsets, with a stated preference for UNFCCC credits as long as they follow additional ICAO rules. As of the last ICAO session in June, the 36 negotiating parties, who are also parties to the UNFCCC, couldn't agree to more stringent rules, with Brazil and China posting the heaviest opposition. There is

a stalemate over the restriction of credits from the Clean Development Mechanism (CDM), which has the ability to supply well over the needed demand from the aviation sector, but has been riddled with environmental and social controversies. China and Brazil represent two of the most prolific countries for CDM projects, and are firmly opposed to going beyond existing offset rules.

Many CDM projects and the credits they generate have been analysed since the measure was introduced in 2000. More recent studies only confirm the problems, and led the Economist to conclude in 2012 that the CDM was “a complete disaster in the making”¹. A study commissioned by the European Commission found that only two per cent of CDM projects were likely to have generated new emission reductions². This would mean that the use of these credits for aviation pollution would generate no new reductions in overall pollution levels – in essence, aviation emissions continue to rise and we do nothing more to reduce its climate footprint.

This is despite the fact that the cost of changing pollution trends in the sector would be negligible. The industry has stated publicly that it could absorb a cost of over 18 euros per tonne of pollution without significantly impacting the growth of the sector³. If CDM credits were allowed they could supply the entire demand of CORSIA for under one euro per tonne⁴. For reference, the EU Emissions Trading System, which covers aviation, required airlines to purchase allowances for almost 18 euros per tonne as of early August.

Airlines will start offsetting pollution above the levels they reach in 2020, so levels will grow even more before a small portion is offset in a few years' time. 2020 represents the end of the second period of the Kyoto Protocol and should

mean a resetting of failed policies for a higher ambition level and increasingly stringent rules. The years of attempted reform of market mechanisms under the Kyoto Protocol have not materialised and the summary of their impact on the environment is a convincing obituary for these mechanisms.

Should policy-makers decide that the potential unused supply of almost five billion pre-2020 CERs (credits from the CDM) are eligible to meet post-2020 targets under the Paris Agreement or the CORSIA aviation offsetting scheme, the Paris effort will be weakened by the equivalent of one-year's pollution from the EU-15⁵. What's more, the utility of elaborating Article 6 rules is substantially reduced, since CORSIA, the largest source of demand for offsets, will satisfy its climate obligation through a loophole that permits the use of outdated credits – left unpurchased because of quality concerns.

The idea that the airline industry could give the CDM a new life conjures up images of unaccountable businessmen hiding behind PR to continue their dirty work. From the early discussions of an economic instrument to curb emissions in the aviation sector, ICAO landed on the cheapest, most contentious, and finally outdated policy instrument out there – offsetting. The least that can be done is a requirement to allow only new projects and credits that take place post-2020, at the same time as the pollution that should be compensated.

This important decision on the time-frame of eligible projects will be decided by ICAO in early November, just before COP24, and will fundamentally decide on whether to extend the lifeline of failed environmental market policies. ICAO has an opportunity to show us its roadmap to limit warming to 1.5°. Transforming the economy requires progress towards raising the price of pollution and lowering the levels of pollution. Purchasing offsets from





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the CDM opposes this objective. Will the ICAO opt for CDM credits, defending an option that will not move us one inch closer to averting climate change, and effectively ruin the future for market measures under the Paris Agreement? Or will the ICAO internalise the cost of its pollution in a credible way and assure the quality and contribution of the sector to the massive efforts needed to limit global warming?

The IMO should take note of the landmines the ICAO is facing from both a technical and political level to make off-setting work post-2020. Instead, a levy to recycle funds in a more environmental and future-proof way, with the aim of making the shipping sector more resilient, is not only common sense, it would also save the industry from having to wrap their heads around carbon markets. Win-win for everyone.

Kelsey Perlman
Carbon Market Watch

¹ <https://www.economist.com/finance-and-economics/2012/09/15/complete-disaster-in-the-making>

² https://ec.europa.eu/clima/sites/clima/files/ets/docs/clean_dev_mechanism_en.pdf

³ https://www.icao.int/Meetings/HLM-MBM/Documents/HLM_GMBM_IATA_WP12_en.pdf

⁴ <https://newclimate.org/wp-content/uploads/2018/03/Marginal-cost-of-CER-supply.pdf>

⁵ Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom

Germany must exit coal quickly

A study conducted by the Fraunhofer Institute for Energy Economics and Energy System Technology posits that Germany can still meet its 2020 emissions reduction target.

This summer's heatwave showed that Germany must exit coal quickly, according to Greenpeace Germany. On 8 August, 10 Greenpeace activists ascended a glacier on Germany's highest mountain, the Zugspitze, to unfold a banner saying "Summer 2018: heat, drought, glacial melting – Start coal exit now!" Greenpeace spokesperson Thilo Maack said the extreme weather events correspond to global warming forecasts. "We are in the midst of the climate crisis and it will get increasingly worse. The rapid speed of climate change stands in sharp contrast to the snail's pace of policy. Germany must urgently shut down the first lignite plants, which are particularly harmful. In 2030, the last coal-fired plant must be off the grid." A Greenpeace-commissioned study conducted by the Fraunhofer Institute for Energy Economics and Energy System Technology posits that Germany can still meet its 2020 emissions reduction target, provided that several brown-coal-fired power plants are immediately retired and others are throttled back. "Germany

can achieve its promised 40-per-cent greenhouse gas emissions reduction while ensuring its energy supply. The technical possibilities aren't lacking – only the political will," Anike Peters, Greenpeace energy expert, said.

The German government announced in June that it would widely miss its target of reducing the country's greenhouse gas emissions by 40 per cent by 2020 relative to 1990 levels. The Fraunhofer study developed two scenarios in which Germany could meet the aforementioned target. If the much-anticipated special auctions for renewable energies are held, 6.1 gigawatts of lignite-fired power would need to be taken off the grid immediately; if they are further delayed or not held at all, 7.4 gigawatts would have to be retired, the study says. Greenpeace calls for a complete phase-out of hard coal and brown coal by 2030 at the latest.

Source: Clean Energy Wire

<https://www.cleanenergywire.org/news/2020-climate-target-still-within-reach-study-wake-call-germany>

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Europe still building new coal power stations

Several countries in Europe have recently built or are planning to build new coal power stations. Some examples from Germany were described in the last issue of Acid News (AN2/2018), and further examples of such plants from Eastern Europe are presented here.

Turów and Bełchatów, Poland

In south-west Poland at Turów, PGE Polska Grupa Energetyczna began construction of a 450 MW lignite plant in May 2015 to complement the existing six 250 MW turbines. Originally scheduled for completion in 2018, the new block will now be entering service in the second quarter of 2020.

Europe's largest lignite power station at Bełchatów, with 5,354 MW of generation capacity has been modernised for extended operation. All major lignite sites are prepared for CCS retrofits if necessitated by EU decarbonisation strategies, with CO₂ storage intended under the Baltic Sea.

A projected 100 km² lignite surface mining site is undergoing preliminary licensing at Gubin-Brody across the Neisse River from the German Jänschwalde power station. Annual production of 17 Mt is planned over 49 years from

seams 140 m deep. If the project application is approved, PGE intends to erect three 830 MW generation plants for operation beginning in 2030.

In Poland and the Czech Republic, over 40% of the building infrastructure is provided by heating energy from lignite and coal power plants. In the case of Poland, hard coal is used to supply 43% of overall heating demand, compared to 12.9% for lignite. The Czech Republic produces four times the networked heating energy per inhabitant of Germany.

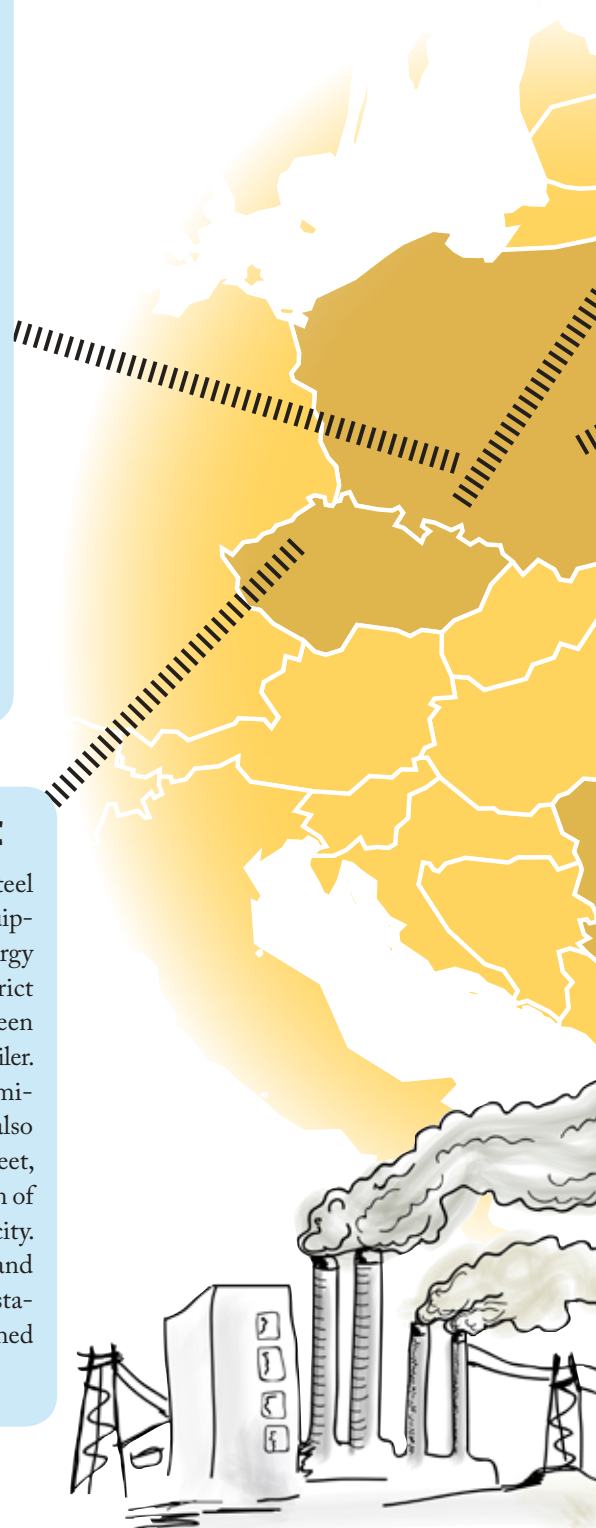
In the future, coal-related emissions may be reduced in municipal heating systems by substituting surplus thermal energy from alternative sources such as waste incinerators, recycled industrial heat, subway tunnels, and excess renewable power.

Lignite power plant at Ledvice, Czech Republic

After the revocation of lignite excavation limits imposed in 1991 by Parliamentary Resolution 444, mining operations are being prolonged from 2036 to 2049 at Bílina to supply an additional 100 Mt of lignite to the newly constructed Ledvice 660 MW power plant. The single-generator design expands the existing 330 MW electrical capacity while distributing heat to 300 commercial customers and 20,000 private households at Ledvice as well as in Teplice and Bílina. The original planned operational date of 2012 has been repeatedly delayed, notably due

to the replacement of faulty T24 steel boiler segments and subsequent equipment malfunctions. The thermal energy contracted since 2015 for local district heating services has meanwhile been supplied by a provisional gas-fired boiler.

Since the 1990s, the Czech semi-state energy corporation ČEZ has also upgraded its existing power plant fleet, beginning with the desulphurisation of 6,462 MW of installed lignite capacity. The Tušimice II (4 x 200 MW) and Prunčřov II (5 x 210 MW) power stations have been completely refurbished for generation until at least 2040.



Opole, Poland

The construction of two supercritical 900 MW blocks 5 and 6 has been completed by PGE Opole in south-western Poland to realise the country's second-largest hard coal installation and supplement the existing 1,532 MW four-block power station. Unit 5 is due to enter commercial service in 2018 and block 6 the following year.

New coal generation at Kozienice, Poland

On 19 December 2017, Kozienice became the largest and most modern hard coal generating site in Europe with the addition of the €1.5 billion 1,075 MW generator block B11 by the state energy company Enea. The facility as a whole has a capacity of nearly 4,000 MW, requiring three million metric tons of coal annually.

For Prime Minister Mateusz Morawiecki, the new plant exempli-

fies the need to “increase the energy security of Poland and the Polish people, which is an economic and political priority for our country”. Domestic lignite and hard coal currently fulfill 56% of total energy demand in Poland and account for nearly 90% of electrical power generation.

Balkan lignite dependency

Lignite significantly contributes to domestic energy security in the former Yugoslav states. Mining has been terminated in Croatia, but the Balkan region otherwise remains dedicated to lignite usage. The heating values available in Slovenia (11.3 MJ/kg) and Serbia (7.8–8.2 MJ/kg) are comparable with northern European grades.

Power plant expansions await approval at Kolubaru (2 x 375 MW) in Serbia as well as near Pristina (450 MW) in Kosovo, where Europe's fourth-largest lignite resources (after Poland, Germany, and Serbia) are located. Sensitive environmental information has already become available in the evaluation phase, with arsenic and cadmium determined above threshold inhalation levels in PM₁₀ particles of airborne dust from power plants and surface mines.

Serbia produces half of its total primary energy from lignite. Electricity is used to cover nearly one third of thermal energy demand, followed by 27% district heating and nearly one-fifth biomass firing. Lignite power generation could therefore be progressively replaced by

renewable energies, including expanded hydropower capacities, without the intermediate use of natural gas.

The recently approved ContourGlobal lignite power plant at Pristina is a new single-block design that replaces an earlier proposal for two 300 MW blocks. The Institute for Energy Economics and Financial Analysis has determined, however, that the plant could present a “barrier to competition from lower-cost renewable energy technologies” in Kosovo owing to contract terms that are exceptionally favourable to ContourGlobal. In addition to cost reimbursements for fuel and corporate taxes with only negligible performance penalties, a return on investment of 18.5% is guaranteed. Availability payments covering a wide range of incurred expenses would be paid “regardless of whether electricity is even dispatched”. At best, it may be surmised that Kosovo's extensive lignite reserves provide a degree of debt security that has not yet been attained by the country's economy as a whole.

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Member states ask EU to help hide their air pollution failure

Eleven governments have asked the European Commission to retrospectively raise their “emission ceilings” after breaching their national air pollution limits in 2016, namely: Austria, Belgium, Denmark, Finland, Germany, France, Hungary, Ireland, Luxembourg Spain and the UK.

The EU’s National Emission Ceilings (NEC) directive sets absolute caps for

the annual amount of pollution allowed to be emitted by any one country. However, governments can request that the limits set for previous years be raised, if certain circumstances apply. This process is known as an “inventory adjustment”, but environmentalists say that granting these adjustments undermines the law, as targets can be raised after they have already been missed.

In a letter sent by EEB, ClientEarth and AirClim to European Commissioner

Karmenu Vella, EEB Secretary General Jeremy Wates said that the use of inventory adjustments should be kept to the “strict minimum” and that it should be considered whether governments have taken any action to tackle additional emissions before granting any adjustments.

Source: NGO letter to Karmenu Vella, 31 July 2018.

http://eeb.org/wp-admin/admin-ajax.php?juwpfisad_min=false&action=wpfd&task=file.download&wpfd_category_id=62&wpfd_file_id=93526&token=1bc87c0d3edf12ac066706cf78cc8b34&preview=1



London ULEZ to expand from October 2021

London’s Ultra Low Emission Zone will expand out to the North and South Circular roads from 25 October 2021 and cover an area 18 times larger than the Central London ULEZ, the Mayor of London, Sadiq Khan, confirmed on 8 June.

The ULEZ is to be introduced in the centre of the city from early 2019, before expanding out to the North and South Circulars in 2021 – and will increase the emissions standards for vehicles operating in the capital. Replacing the current T-Charge, the ULEZ would see vehicles that do not meet emission standards liable to incur a daily charge to drive within the zone, ranging from £12.50 for some light vehicles, up to an additional £100 for some heavy goods vehicles which do not meet the Euro VI emissions limit.

Source: AirQualityNews, 8 June 2018.



Frankfurt must ban older diesel cars

Frankfurt must ban highly-polluting, older diesel vehicles from the city centre from February 2019 as part of a plan to improve air quality, the Administrative Court in Wiesbaden ruled on 5 September. ClientEarth lawyer Ugo Taddei said: “Germany’s top court set the direction in February and we are now seeing the domino effect kick in. Courts have now ordered diesel bans in Frankfurt, Düsseldorf, Munich, Stuttgart and Aachen.”

Further clean air hearings are set to follow in the

coming weeks, including in Berlin, Bonn, Cologne and Mainz. Updated air quality plans, which incorporate diesel bans, are due to be published by authorities in Stuttgart and Düsseldorf imminently.

Source: ClientEarth News, 5 September 2018.



Diesel cars cause high health costs

Recent research by scientists at the University of Oxford and University of Bath suggests that the health damage effects associated with diesel vehicle emissions are around 20 times greater than electric vehicles and at least five times greater than those associated with petrol vehicles.

The study generated location-specific per-vehicle costs calculated for cars and vans over an estimated 14–19-year lifespan. For inner city areas such as inner London, the research suggested that

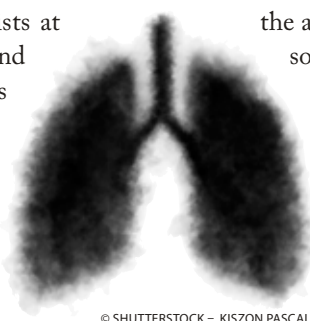
the average cost to the NHS and society of a car is UK£7,714 over its lifetime, while the health damage cost from diesel cars is UK£16,424 and vans 24,555.

Battery electric cars and vans are between UK£827 and 1,443 – the lowest cost, while researchers suggested

that petrol damage costs are UK£2,327 and 10,101 for cars and vans, respectively.

Source: AirQualityNews, 6 June 2018

The report “The health costs of air pollution from cars and vans”: <https://www.cleanairday.org.uk/Handlers/Download.ashx?IDMF=7eb71636-7d06-49cf-bb3e-76f105e2c631>



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Swedes harmed by air pollution

Every year 7600 people in Sweden die prematurely due to nitrogen dioxide and particulate matter, with an annual cost to society of at least 5.3 billion euro.

Even though Sweden has one of Europe's lowest levels of air pollution, each year about 7600 people die prematurely due to exposure to air pollutants, primarily nitrogen dioxide and particulate matter, according to a new study by the Swedish Environmental Research Institute and Umeå University. Each death corresponds to a loss of approximately eleven years of life, and the annual cost to society is conservatively estimated to amount to at least SEK 56 billion (€ 5.3 billion) for the year 2015.

The study focussed on nitrogen dioxide (NO₂) and particles in the size categories 2.5 and 10 microns or less (PM_{2.5} and PM₁₀) and only on regional and urban background concentrations, i.e. roadside concentrations were not addressed.

It was found that most of the PM_{2.5} at urban background stations is transported over long distances, largely from emission sources outside of Sweden. Road dust resulting from the use of studded tires is the largest source of locally generated PM₁₀. The high levels of NO₂ are caused largely by local traffic emissions, with an increased proportion of diesel vehicles exacerbating the problem.

Despite the fact that the overall level of air pollution in Sweden seems to be diminishing, the study shows that total population exposure to air pollution is roughly the same as in previous surveys.

This is explained by ongoing urbanisation – as more people move to the cities, a greater number are exposed to higher levels of air pollution – and by a growing population.

Nearly the entire Swedish population was exposed to concentrations below the EU air quality annual mean limit values, and 97 per cent, 78 per cent and 77 per cent respectively were exposed to concentrations below the stricter national Swedish environmental objectives for NO₂, PM₁₀ and PM_{2.5}.

“New studies on the impact on mortality indicate that the local effects of traffic pollution have been underestimated, so we now attribute more deaths to pollution at lower levels of exposure,” said Bertil Forsberg, Professor of Environmental Medicine at Umeå University.

Of the total 7600 annual premature deaths, approximately 3600 are associated with exposure to regional background concentrations of PM_{2.5}. Locally emitted particles (road dust, wood smoke and exhaust particles) are assumed to have different effects on mortality, but the researchers said they faced problems identifying specific exposure-response functions. Acknowledging this uncertainty, it was estimated that particles from local wood burning cause more than 900 deaths per year, and that particles from road dust cause around 215 deaths per year.

According to the study, the impact on mortality from locally emitted vehicle exhaust emissions, including particles, is best indicated by exposure-response functions for within-city gradients in NO₂, which could also include the effects of NO₂ itself. Using this approach, it was estimated that vehicle exhaust emissions cause approximately 2850 deaths per year.

The socio-economic costs of mortality were estimated by calculating the number of life years lost per fatality (which was approximately 11 years) and multiplying these figures by a value of €40,000. The authors point out that this is a very conservative estimate, so they also did a sensitivity analysis in which they instead used values for a lost statistical life (VSL). If an official Swedish VSL of SEK 23 million is used, the socio-economic costs of air pollution in Sweden in 2015 would be more than three times higher (SEK 185 billion), and if a recent Danish VSL is used instead the costs would rise even more, to SEK 294 billion.

Christer Ågren

The study “Quantification of population exposure to NO₂, PM_{2.5} and PM₁₀ and estimated health impacts” (June 2018). IVL Swedish Environmental Research Institute report No. C317. Available at: <https://www.ivl.se/english/startpage/top-menu/pressroom/press-releases/press-releases---arkiv/2018-06-26-7-600-are-expected-to-die-prematurely-each-year-due-to-air-pollution.html>

Agricultural ammonia emissions keep on rising

Five EU countries breached their national emission ceilings for ammonia in 2016 and total emissions have now increased by two per cent over three years, preliminary data from the European Environment Agency (EEA) shows.

Emissions of ammonia reduce air quality by increasing the levels of health-damaging secondary particulate matter (PM_{2.5}). Moreover, ammonia disrupts land and water ecosystems through eutrophication – the oversupply of nitrogen nutrients with resulting impacts on biodiversity that currently affects more than two-thirds of the total ecosystem area in the EU.

Between 2015 and 2016, ammonia emissions increased in fifteen member states. For the EU as a whole they rose by 0.4 per cent, mainly due to increases in Italy, the UK and Ireland, reported the EEA.

As of 2010, the EU's National Emission Ceilings (NEC) directive requires member states to meet national emission limits for their total emissions of four important air pollutants: nitrogen oxides (NO_x), ammonia (NH₃), sulphur dioxide (SO₂) and non-methane volatile organic compounds (NMVOCs).

However, final emissions data for 2010–2015 and preliminary data for 2016 shows that a number of countries consistently breached their limits for NH₃, NO_x and NMVOCs in all these years. Austria and Ireland have now breached their NO_x ceilings for seven consecutive years, and Germany, Spain and Croatia have all breached their NH₃ ceilings for seven years running (2010–2016).

According to the EEA, emissions from road transport were the main reason for exceedances of the NO_x limits, while emissions from agriculture – mainly from the use of fertilisers and the handling of animal manure – were responsible for excessive NH₃ emissions.

The emission limits were set in the 2001 NEC directive and are applicable from 2010 until 2019. In 2016, a revised NEC directive was adopted that sets new national emission reduction commitments that are applicable in two steps, from 2020 and 2030, respectively (see AN 1/2017, p.7).

With the adoption of the new NEC directive came a so-called flexibility mechanism that allows member states under certain circumstances to “adjust” downwards their reported emissions for compliance assessment with the national ceilings. This also includes retroactive adjustment of the ceilings for the 2010–2019 period. In March this year, adjustment applications were submitted by eleven countries (Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Luxembourg, Spain and the UK). Following a review and possible approval of these applications by the European Commission, the number of countries deemed to exceed one or more emission ceilings in 2016 could decrease from six to four.

The lack of ambition of the new NEC directive, especially regarding the 2020 reduction commitments, has been strongly criticised by environmental organisations. The EEA analysis now shows that in 2016, the aggregated EU emissions for both NMVOCs and SO₂ were already below their respective targets for 2020 (see figure). Moreover, emissions of NH₃ and particulate matter (PM_{2.5}) are already very close to their respective 2020 targets. Only an additional reduction of about two

per cent is required compared to the 2016 level. NO_x is the only pollutant for which a slightly more significant reduction (of 6%) is required by the EU as a whole in order to meet the 2020 commitment.

As well as reporting past emissions, member states must also report projected emissions for future target years, in order to assess whether or not they are on track towards meeting their reduction commitments for 2020 and 2030. According to these projections, only nine countries are on track to meet their reduction commitments set for 2020 for all the five pollutants, and no country is on track to meet all of their 2030 commitments.

This situation should however soon improve as member states have to produce and report by 1 April 2019 national air pollution control programmes (NAPCP) that set out the additional emission abatement measures needed to achieve their future emission reduction commitments.

Christer Ågren

Source: EEA briefing on the NEC directive reporting status 2018 (9 July 2018).

Link: <https://www.eea.europa.eu/themes/air/national-emission-ceilings/nec-directive-reporting-status-2018>

Note: More detailed emissions data are published by the EEA in the report “European Union emission inventory report 1990–2016 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)”, EEA Report No. 6/2018, which is available at: <https://www.eea.europa.eu/publications/european-union-emission-inventory-report-1>

Ammonia emissions increased in fifteen member states.



Table: EU member state progress in meeting 2010 NEC directive emission ceilings and 2020/2030 reduction commitments.

Member state	NOx										NMVOCs										SO ₂										NH ₃										PM _{2.5}					
	2010	2011	2012	2013	2014	2015	2016	2020	2030	2010	2011	2012	2013	2014	2015	2016	2020	2030	2010	2011	2012	2013	2014	2015	2016	2020	2030	2010	2011	2012	2013	2014	2015	2016	2020	2030	2020	2030								
Austria	X	X	X	X	X	X	X	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	✓	X						
Belgium	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Bulgaria	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X				
Croatia	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	X	X	✓	✓	✓	✓	✓	✓	✓				
Cyprus	✓	✓	✓	✓	✓	✓	✓	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Czech Rep.	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓			
Denmark	X	X	X	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	✓	✓	✓	✓	✓	X	X	✓	X	✓	X				
Estonia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓			
Finland	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X		
France	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	X	✓	X			
Germany	X	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	✓	✓		
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Hungary	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Ireland	X	X	X	X	X	X	X	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	X	X	X	✓	✓	✓	✓	✓	✓	✓		
Italy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	X		
Latvia	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓		
Lithuania	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X		
Luxembourg	X	X	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	X	✓	X	✓	X	
Malta	X	X	X	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	✓	✓	✓	✓		
Netherlands	X	X	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Poland	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	X	
Portugal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Romania	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	
Slovakia	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	X	✓	X	
Slovenia	X	X	X	X	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	X	✓	X	
Spain	X	X	X	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	X	✓	X	✓	X	
Sweden	X	X	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	✓	✓	✓	✓	✓	
UK	X	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	X	✓	X	✓	X	
✓	14	18	20	24	25	26	26	22	10	21	26	26	26	27	27	27	23	12	28	28	28	28	28	28	28	26	11	22	22	23	24	24	25	23	15	10	18	10	10	10	10	10	10	10	10	
X	14	10	8	4	3	2	2	6	18	7	2	2	2	1	1	1	5	16	0	0	0	0	0	0	0	2	17	6	6	5	4	4	3	5	13	18	8	16	16	16	16	16	16	16	16	16

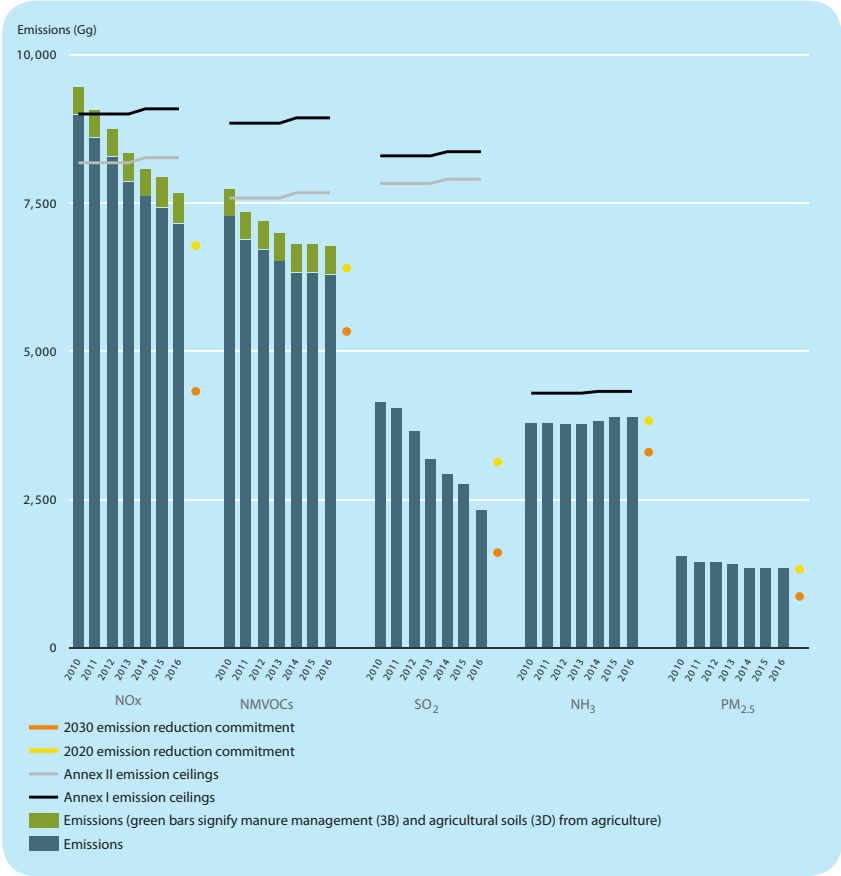
Notes: '✓' indicates that the emission ceiling or reduction commitment has been, or is anticipated to be, attained. 'X' indicates that the ceiling or reduction commitment has not been, or is not anticipated to be, attained. The 2020 and 2030 columns represent projections calculated by member states on the basis of adopted policies and measures currently in place.

Figure: EU progress in meeting the 2010 emission ceilings and the 2020/2030 reduction commitments for the EU as a whole.

Notes: Croatia joined the EU in mid-2013, so for the years 2010–2013 emissions and ceilings are not considered for this country.

The distance to ceilings was calculated taking into account adjusted emissions as approved by 2017.

To assess future attainment of 2020 and 2030 reduction commitments, emissions of NOx and NMVOCs from two main agricultural activities, manure management (3B) and agricultural soils (3D), are not considered. The magnitude of these emission sources is indicated by the top part of the NOx and NMVOC columns. Thus, only the lower part of the NOx and NMVOCs columns should be considered for comparison with the 2020 and 2030 reduction commitments.



Three easy apples to pick

Some types of change require long-term planning, new institutions, educating a new generation etc. Other things are so easy to do that they should have been implemented yesterday.

In the report “Measures to address air pollution from agricultural sources”, the International Institute for Applied Systems Analysis (IIASA) points at three areas where EU member states can achieve quick and cheap results to reduce ammonia and PM emissions from agriculture: the open burning of agricultural residues, mineral fertiliser application, and manure management.

1. Agricultural waste burning

Remote-sensing data shows that the burning of stubble and other agricultural residues is still common practice in parts of the European Union. Setting a field on fire is a quick way to remove crop residues, but depletes the soil of carbon and causes massive emissions of particles. In Bulgaria, Cyprus, the Czech Republic, Greece, Malta and Romania, the burning of agricultural waste contributed to more than 10 per cent of total fine particulate matter (PM_{2.5}) emissions in 2015.

This despite the fact that the practice is banned under Good Agricultural and Environmental Condition (GAEC) standards in most EU countries. This means that farmers who persist in burning their fields under the Common Agricultural Policy regulations should lose

some of their direct payments. In view of this, it is likely that member states need to improve their training of farmers, as well as monitoring and law enforcement. The study points out that the cost of implementing a ban is close to zero or may even be profitable, because of the increased soil fertility that follows.

2. Mineral fertiliser application

Mineral fertilisers contribute to almost one-fifth of EU ammonia emissions. Two main types of nitrogen mineral fertilisers are used in Europe: ammonium- or nitrate-based salts, and urea. The latter causes 50 per cent of all ammonia emissions from fertilisers, but only provides farming with 18 per cent of the fertiliser nitrogen. The use of urea varies between member states, from none at all in Sweden, Denmark and Belgium, while southern and eastern European countries, as well as Germany and the UK, have higher shares of urea in their fertiliser mix. In Germany it is even reported that the use of urea is growing. The report does not suggest a ban on urea, but two more moderate approaches:

- Increased nitrogen use efficiency. There has been a 20 per cent reduction in fertiliser use in the European Union since the peak in 1988. A wider adoption of precision farming is suggested as a tool to increase nitrogen efficiency by 10–15 per cent without impact on crop

yields. Automatic guidance systems for farmers offer a cheaper and increasingly popular technique for optimising the use of fertilisers.

- Urease inhibitors. Urease is an enzyme that catalyses the hydrolysis of urea into carbon dioxide and ammonia. There are urea fertilisers coated with certain chemicals that suppress the activity of urease. The slower release will result in less excess ammonia that can escape in gas form. The urease inhibitors can reduce ammonia emissions from urea application by as much as 95 per cent.

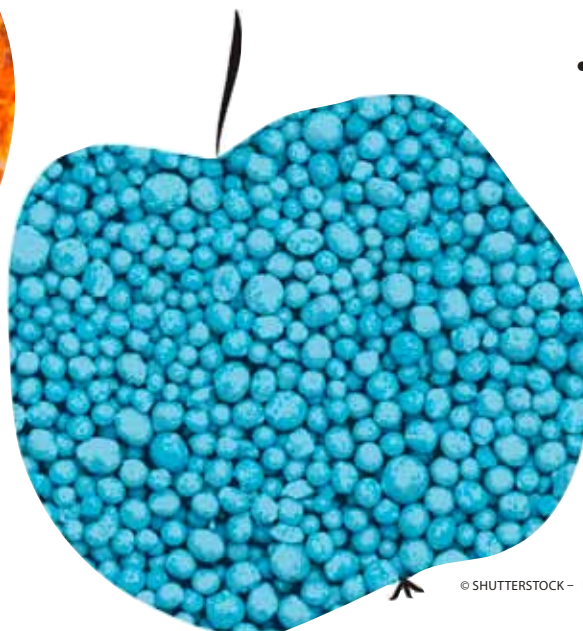
3. Manure management

Livestock farming, including manure management, contributes to around 70 per cent of the ammonia emissions in the European Union. The dominance of this source is seen across all member states, even though the types and structures of animal farming are very varied. The number of animals, method of housing and manure systems, land availability, soil type etc. all affect which measures are practical to implement.

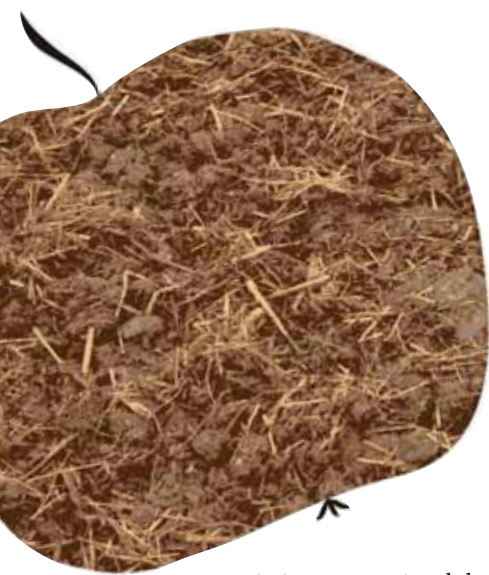
- Extended grazing. Provided that there is enough land, ammonia emissions are much lower in a 24-hour grazing system than for animals that are kept indoors.
- Optimised animal feeding. Adjusting the protein content of animal feed at different stages of growth is a technique that is already widely used. It is appealing to many farmers since it can reduce costs for feed.
- Treatment of exhaust air (ventilation). In the Netherlands, scrubbers that remove PM₁₀, ammonia and odour are required for animal housing close to Natura 2000 areas. The most advanced systems can remove up to 90 per cent of the ammonia emissions. These systems are expensive to install. The cost is tougher for small farms to bear and if it is made mandatory it could contribute to structural changes.
- Storage of manure. In the European Union 18 per cent of ammonia



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emissions are emitted during manure storage. Different types of cover can reduce these emissions. The most effective, but also the most expensive, are airtight lids. Straw, woodchips or just allowing the formation of a crust are inexpensive techniques that could be implemented everywhere.

- **Manure injection.** There are several techniques to reduce air contact while applying manure to a field. Deep injection (5–20 cm depth) is the most efficient, reducing emissions by up to 95 per cent. Diluting manure with water and direct incorporation through ploughing are techniques that do not require specialised equipment and can be effective.
- **Slurry acidification.** This is a common technique in Denmark when applying cattle manure. Higher acidity inhibits bacterial urease formation, which reduces the conversion rate to ammonia (NH_3), and any ammonia formed is converted to the less volatile ammonium (NH_4^+). Emissions are reduced by 50–60 per cent. One drawback is that it requires the potentially hazardous handling of strong acids.

Besides these specific practices the report recommends that countries develop national strategies that aim at an integrated approach for managing emissions from livestock farming. They highlight examples from Germany, the Netherlands and Switzerland that include tightening of regulations and investment support for low-emission techniques.

Kajsa Pira

Measures to address air pollution from agricultural sources, IIASA, December 2017, http://ec.europa.eu/environment/air/pdf/clean_air_outlook_agriculture_report.pdf

Support for renewables over coal in Turkish poll

While Turkey's President Recep Erdogan has strongly promoted new coal power plants, only 5.2 per cent of 2595 residents surveyed preferred coal power, compared to 70 per cent support for solar and 52.8 per cent support for wind generation. Of those surveyed, 53.1 per cent opposed the construction of coal plants near them. January 2018 data from the Global Coal Plant Tracker indicates that Turkey has 51 proposed coal units with a combined capacity of 41,760 MW, the world's third-largest potential coal plant pipeline.



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Source: Global Coal Plant Tracker <http://www.climatechangenews.com/2018/06/05/83-turks-favour-renewable-energy-coal-survey-finds/>

Wind farms and birds

Wind farms are far less harmful to birds than first thought, according to the biggest ever study on the subject published in April, because seabirds actively change their flight paths to avoid them.

Researchers used radar and video to monitor seabirds flying near Vattenfall's Thanet offshore wind farm in the English Channel over a two-year period. They found that birds were present near the turbines in just two per cent of the 600,000 videos shot during the period, and they recorded just six collisions – an average of one every four months. Previously it was thought the number of birds being killed by wind farms was more than double that figure. During the Offshore Renewables Joint Industry Programme (ORJIP) bird collision avoidance study, seabirds were observed to exhibit avoidance behaviour and change their flight paths to avoid the turbines. The study included bird experts and was also welcomed by the Royal Society for the Protection of Birds (RSPB). A 100-metre-high wind turbine has been generating power at the headquarters of the RSPB since 2016. The NGO has more than a million members and is one of the largest national wildlife conservation charities in Europe. The Independent wrote in 2016 "that pursuing wind power is not without controversy for the RSPB, as critics of the technology warn that turbines pose a threat to birds, particularly rare species that are already suffering from low numbers or migratory species, as well as to bats. But an

article in the journal Nature a few years ago pointed out that turbines killed far fewer birds than other human causes such as buildings, cars, power lines, pesticides and pet cats. The RSPB warns climate change is the 'single biggest threat' to birds and other wildlife and says it has been involved in hundreds of wind-farm applications to make sure local bird nesting activity, migratory patterns and flight paths are taken into account". The Independent article concludes with a statement from RSPB director of conservation Martin Harper: "Climate change is the single biggest threat to our planet. This is about our birds and wildlife as well as our way of life".

Compiled by Reinhold Pape

<https://www.telegraph.co.uk/science/2018/04/19/wind-farms-less-harmful-seabirds-first-thought/>

<https://www.independent.co.uk/environment/rspb-bird-friendly-wind-turbine-will-cut-carbon-emissions-by-800-tons-a-year-a6902271.html>



A smorgasbord of sustainable solutions

Environmentally aware public procurement and the inclusion of sustainability in dietary guidelines are some measures already taken in the transition towards a sustainable food system.

“The Solutions Menu”¹ is a report from the Nordic Council of Ministers featuring 24 practical examples of measures within the food sector in the Nordic countries. Around half of them are directly or indirectly relevant for environmental sustainability. Here follows some of the most interesting.

A holistic approach

Unlike many other similar documents, the “Climate Programme for Finnish Agriculture – Steps towards Climate Friendly Food”², published in 2014, includes measures on both the production side and consumption side. This dual approach increases the likelihood that unwanted effects such as “carbon leakage” due to food imports and exports are detected and dealt with. One of the areas of action is reducing meat consumption, since “lower meat consumption is the main means for reducing greenhouse gas emissions from food consumption”. The suggested measures include developing domestic plant-based proteins and more advice for public kitchens.

Climate-smart food models

S.M.A.R.T. is an abbreviation for a checklist used by public kitchens in Sweden since 2001³, in order to reduce environmental impact and improve health. The

model entails: a larger proportion of vegetable-based food; fewer empty calories; a higher proportion of organic food; the right choice of meat and vegetables; and cutting down on transport.

The Danish Food and Veterinary Agency gives practical advice to consumers on how to eat more climate friendly.⁴ The recommendations include: finding climate-friendly alternatives to favourite foods (especially alternatives to meat); using more seasonal vegetables in all meals; consuming fish from Denmark; planning trips to the supermarket so as not to waste fuel on unnecessary trips; and avoiding the waste of food by eating leftovers.

Dietary guidelines

Back in 2012 the Nordic Nutrition Recommendations⁵ included a chapter about sustainable food consumption. One conclusion was that eating according to the recommendations has a lower environmental impact than the average Nordic diet.

Two years later, in 2014, the Finnish Nutrient Recommendations⁶ advocate higher intakes of vegetables, berries, fruit, whole-grain cereal products and fish, and lower intakes of red meat and meat products in general. If people were to follow these recommendations the environmental impact from food could

be reduced by 20 per cent according to the document.

When the Swedish dietary guidelines⁷ were updated in 2015 they included wordings that acknowledge that plant-based foods have less of an environmental impact than foods of animal origin. Decreasing the consumption of foods of animal origin and increasing the consumption of plant-based foods is recommended to reduce the climate impact of the modern Swedish diet.

Finally, the Norwegian National Action Plan for a Healthier Diet⁸, published in 2017, suggests that a diet consisting of more fruit and vegetables, more fish and less meat, is a more sustainable diet.

Local government procurement

In 2006, the City of Copenhagen raised their goal for organic ingredients in meals cooked in public kitchens from 45 per cent to 90 per cent by 2015. This should be done without any additional funding, which required kitchens to rethink menus, work flows, food waste and procurement. The aim was also to improve the quality of food.

Since then other Nordic cities have set similarly ambitious targets:

- Malmö, Sweden (population: 341,000): 100% organic by 2020, goal set in 2010
- Helsinki, Finland (population: 630,000):

Denmark to ban new fossil fuel cars by 2035

The Danish government has launched a climate and air pollution package called “together for a cleaner world”, which includes 38 initiatives. The country aims to ban sales of petrol and diesel cars by 2030 and sales of plug-in hybrids by 2035. This should be enough to achieve a fossil-free car fleet by 2050. This would reduce annual CO₂ emissions by 7 million tonnes. They also intend to set up a scrapping premium for diesel cars.

Besides transport measures, the package also includes initiatives to promote precision farming with the ambition to reduce ammonia emissions, and improved monitoring of sulphur emissions from the shipping sector.

Source: ENDS Daily 9 October 2018

EU livestock numbers are too high

“What is the Safe Operating Space for EU livestock?” is the question at issue and the title of a new report from the Rise Foundation. Their preliminary analysis shows that the numbers of farm animals in Europe would have to decrease by 40–60 per cent to limit the negative effects of greenhouse gas emissions and nutrient leakage.

To achieve this, they conclude that strong action is required both on consumption and in production. There is however considerable scope for innovation to reduce negative impacts by improving resource efficiency, breeding, housing, nutrition, manure management and changing the density and concentration of production. The report stresses that production measures alone cannot offer sufficient rates of efficiency improvement to achieve existing standards for greenhouse gases and other pollutants.

Report: <http://www.risefoundation.eu/publications>



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- 50% organic in preschools and day-care centres by 2015, goal set in 2011
- Gothenburg, Sweden (population: 572,000): 100% organic meat, goal set in 2014
- Lund, Sweden (population: 119,000): 100% organic food by 2020, goal set in 2015
- Oslo, Norway (population: 672,000): 50% organic food by 2020, goal set in 2016
- Lejre, Denmark (population: 27,000): 75% organic food by 2021, goal set in 2017

Besides these local initiatives the report also highlights different national strategies with targets to increase the production and consumption of organic food, such as the “Finland more organic plan” from 2013 and the “Organic Action Plan for Denmark” from 2015.

National food waste strategies

Three of the measures deal with food waste. This includes collecting data to better understand the dynamics of food waste, stakeholder involvement and support for innovative projects. One very hands-on action point has been to review the “best-before” labels on food. It was found that there were huge variations in the estimated durability within different product groups. Many companies have now taken upon themselves to make changes. One of Norway’s largest dairies has added “but-not-bad-after” dates to encourage consumers to use their own discretion to determine if a food item is edible or not.

A sustainable food culture

The link between gastronomy and sustainability is not obvious. In 2004 the Danish

TV chef Claus Meyer and scientist Jan Krag Jacobsen drafted the New Nordic Food Manifesto⁹ as a starting point for a new movement. The ten-point manifesto acknowledges that ethical production should be a core value for the Nordic Kitchen, beside more culinary aspects such as food quality and taste, and this includes using local ingredients in season.

The report describes a trickle-down effect: when fine-dining restaurants started to embrace kale and turnips this inspired lunch restaurants, school canteens and families to follow this new style of cooking.

Kajsa Pira

Further reading:

1 <http://norden.diva-portal.org/smash/get/diva2:1214792/FULLTEXT01.pdf>

2 https://mmm.fi/documents/1410837/1890227/Climate_programme_agriculture_WEB_03072015.pdf/ (in English)

3 <https://www.folkhalsomyndigheten.se/contentassets/aa6146887ffb468b8d1efa2b955adef2/hur-man-ater-smart.pdf> (in Swedish)

4 <https://altomkost.dk/nyheder/nyhed/nyhed/sund-og-klimarigtig-mad-paa-menuen-i-2018/> (in Danish)

5 <http://www.norden.org/en/theme/former-themes/themes-2016/nordic-nutrition-recommendation/nordic-nutrition-recommendations-2012> (in English)

6 <https://www.evira.fi/en/foodstuff/healthy-diet/nutrition-recommendations-for-all/> (in English)

7 <https://www.livsmedelverket.se/globalassets/publikationsdatabas/andra-sprak/kostraden-eng-a4-utskriftversion.pdf> (in English)

8 regeringen.no/contentassets/fab53cd681b247bfa8c03a3767c75e66/norwegian_national_action_plan_for_a_healthier_diet_an_outline.pdf (in English)

9 <http://www.norden.org/en/theme/ny-nordisk-mad/the-new-nordic-food-manifesto>

Climate-vulnerable countries: 2015 commitments are outdated

The Climate Vulnerable Forum (CVF) has urged countries to step up and revise their national climate plans without further delay. "Growing climate risks, economic and technological developments in low-carbon technology, as well as increased action by sub-national actors, make the national climate plans submitted by governments in 2015 outdated and requiring review," said CVF. "1.5C is completely feasible, but it requires bold political will. All countries must internalise the urgency and start the process of revising their current national targets no later

than January 2019 to secure survival and prosperity for all of us."

The current commitments made by countries in 2015 lead to dangerous warming that can reach 3 or 4 degrees Celsius. The gap is wide with the 1.5C target set in Paris. "It is imperative that the Talanoa Dialogue should deliver a political outcome in COP24 that triggers a process of revision of national targets before 2020."

<https://thecvf.org/vulnerable-countries-urge-all-to-step-up-climate-targets-for-1-5c/>



You know the feeling when small countries end up being underwater and they tell you to rewrite your national climate plan.

Sweden to stop using coal for energy in 2022

The burning of coal for heat and power in Sweden will stop in 2022, which is the deadline for the combined heat and power plant in Stockholm.

The Västervik plant, 100 kilometres west of Stockholm, unloaded its last coal in November 2017 and will stop using it in 2020, when a new boiler for recycled waste wood will be commissioned.

In 2021 Linköping, 200 kilometres south of Stockholm, will stop using coal and oil.

Sweden's power system has never used much fossil fuels, due to the country's huge hydro resources, and an enormous nuclear programme. At the peak it had 12 reactors, of which eight remain, with another two to go by 2020. In recent years wind power has contributed about 17 TWh, equivalent to about three nuclear reactors.

District heating is very big in Sweden and was usually built by local government.

About half of all space heating comes from district heating – about 180 PJ, or 50 TWh.

District heat was initially fuelled with oil and waste, and later also coal, gas, peat and biomass. Some of it is just for heat, some of it combined with the cogeneration of electricity (CHP). Only about half of district heat has CHP due to the historically strong market position of the power companies. They, led by Vattenfall, controlled most hydro, all nuclear and the few thermal power stations.

With coal about to be phased out, Swedish district heat and CHP are dominated by biofuels and waste heat from industry.

Natural gas is on the wane. E.ON started building a gas power

plant in Malmö in 2010, but it has been mothballed for years due to high prices for gas and low prices for electricity.

Peat is still used, though it is on the wane. The largest user, Uppsala (Vattenfall), will stop using peat in 2019. Peat use for heat and power in Sweden decreased from 3.9 to 1.3 TWh between 2009 and 2017.

Waste combustion is big, however, and is still growing. As household waste recycling improves for paper and biogenic waste (for biogas production), the share of plastics increases, and with it CO₂ emissions.

CO₂ emissions from district heat nevertheless keep dropping, and amounted to 70 kg/MWh in 2017.

Fredrik Lundberg

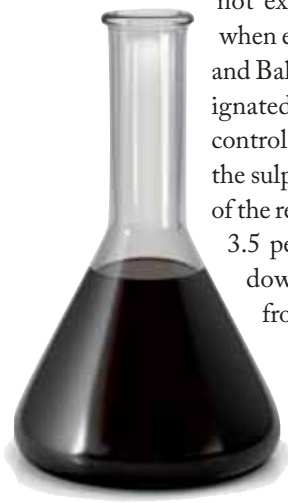
Värtaverket in Stockholm, the last coal-fired heating plant in Sweden.

Sweden will fine high-sulphur ships

After years of preparatory work, the Swedish government has now finally introduced economic sanctions on ships using illegal high-sulphur fuel. The minimum penalty fee is SEK 5,000 (€482) and the maximum SEK 500,000 (€48,200). The higher the engine power and the fuel sulphur content, the higher the penalty. If a company continues to violate the rules the fee can be doubled, potentially reaching SEK 1 million.

As from 1 January 2015, EU legislation as well as rules set by the International Maritime Organization (IMO) require ships to use fuels with a sulphur content not exceeding 0.1 per cent when entering the North Sea and Baltic Sea, which are designated as sulphur emission control areas. In comparison, the sulphur standard for most of the rest of world is currently 3.5 per cent, but will come down to 0.5 per cent as from 2020.

Source: Press release from the Swedish Ministry of Environment, 1 June 2018



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Copenhagen mayor wants to ban wood-burning stoves

Copenhagen Mayor Frank Jensen wants to reduce air pollution by banning new wood-burning stoves and offering householders a cash incentive to scrap their old stoves and switch to district heating. Jensen would like to see the cash incentive funded by the state, but if it is unwilling to do so, Copenhagen Municipality is seeking permission to set up a local scrappage scheme.

“In a city where we’ve got district heating in every house

there’s no need for wood-burning stoves as a heat source. They are only for ‘hygge’ (cosiness) and that kind of ‘hygge’ is something we will have to wean ourselves off,” he said.

There are more than 16,000 wood-burning stoves in Copenhagen and Frederiksberg, and one study has estimated that 77 premature deaths in 2014 could be directly attributed to particle emissions from wood-burning stoves.

Source: chppost.dk, 30 August 2018

<http://cphpost.dk/news/nature-news-in-brief-mayor-wants-to-rid-copenhagen-of-polluting-wood-burning-stoves.html>



A stove where it belongs nowadays – at the Danish National History Museum.

FlickR.com / THOMAS QUINE CC BY

No more sales of wet firewood in the UK

Retailers could face restrictions on selling wet wood as a fuel for household heating, under plans announced by the UK government on 17 August to tackle particulate (PM) air pollution, following on from the launch of the government’s Clean Air Strategy this summer.

The burning of wood and coal in the home is said to be the largest single source – contributing 38 per cent – to PM pollution, compared with 16 per cent from industrial combustion and 12 per cent from road transport.

The consultation proposes a series of measures aimed at reducing PM emissions from domestic fuel combustion, including restricting the sale of wet wood for domestic burning, applying sulphur standards and smoke emission limits to all solid fuels and



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Report suggests sales restrictions.

phasing out the sale of traditional house coal. The government has said it will also ensure that “only the cleanest stoves” are available for sale by 2022.

Source: AirQualityNews, 17 August 2018

<https://www.airqualitynews.com/2018/08/17/retailers-could-face-limit-on-sales-of-wet-wood/>

Zero-emission construction machinery

Construction sites are the source of various forms of pollution, such as material waste, visible dust, noise, and vibration. But they also produce air pollution, especially nitrogen oxides (NOx) and particulate matter (PM). A new report by Bellona takes a closer look into the potential of electrified construction site machinery, the solutions which exist today, the current policy and market advances in this regard. It goes on to provide some forward-looking policy recommendations, drawing on EU legislation that is undergoing reform, and pending transposition at national levels.

Source: Bellona, 6 June 2018

<http://bellona.org/publication/zero-emission-construction-sites-the-possibilities-and-barriers-of-electric-construction-machinery>



Solar radiation management (SRM) and geoengineering are not needed

SRM is perilous, as the consequences of intervening in a highly complex system are unpredictable. Actual GHG emissions cuts can achieve more, faster, surer, cheaper and without the risk.

Solar radiation management, SRM, is a group of proposed geoengineering technologies that aim to reduce the inflow of solar energy, rather than to reduce global warming by reducing greenhouse gases. It aims to offset greenhouse warming by reducing the incidence and absorption of incoming solar (short-wave) radiation (often referred to as insolation). Solar radiation management (SRM) methods propose to do this by making the Earth more reflective, that is by increasing the planetary albedo, or by otherwise diverting incoming solar radiation. This provides a cooling effect to counteract the warming influence of increasing greenhouse gases.

The physics of SRM is, in principle, rather straightforward. A doubling of the atmospheric CO₂ concentration compared to the pre-industrial level would cause a warming of about 4 watts per m². This is a small number in relation to the 107 watts that is reflected, so if 111 watts were reflected instead, there would be no global warming.

The case for SRM is simple: by shading our planet from a small proportion of sunlight, global warming can be halted, even reversed, in some cases fast and in some cases possibly at low cost.

For obvious reasons global warming will hit hot regions disproportionately, which risks making SRM a North-South issue. A group of scientist claiming to be neutral about SRM recently accused the ETC group (an NGO critical of SRM) of “paternalism” in an opinion article for Nature headlined “Developing countries must lead on solar geoengineering research”.

A case could easily be made for the opposite view, that SRM is yet another way for the North to procrastinate and escape responsibility for emissions. As the Nature article points out, “most solar-geoengineering research is being done in the well-heeled universities of Europe and North America”. It could also be added that substantial funding comes not only

from the rich countries but also from rich northern philanthropists. The main danger of northern paternalism towards the global south may not necessarily come from small NGOs.

Another line of argument for SRM, by Mike Muller at Witwatersrand University, South Africa, goes:

“Africa must look hard at uncomfortable options or face being left behind by other countries with fewer scruples.”

It is not clear whether Muller just means that the front-runner of a technology will reap the fruits compared to later adopters, or if he means that someone else will actually steal the rain before it reaches Africa.

What actually constitutes an SRM technology is neither theoretically nor empirically well defined, but the following are often mentioned.

Surface albedo methods include white roofs and brightening of human settlements, introducing more reflective crop varieties by selection or genetic engineering, the conversion of forests to grasslands, desert reflectors (mirrors) on an enormous scale, afforestation in deserts such as the Sahara to increase evapotranspiration, deforestation at high latitudes (where trees are much darker than snow cover), and spreading white sand on dark soil. Yet another method is making the oceans brighter with chemicals that create small bubbles in the water or, in a more limited way, just making the wakes of ships longer and brighter.

Cloud albedo enhancement means making the clouds whiter, by spraying salt water into them.

Stratospheric sulphur or the injection of other particles makes the high atmosphere hazier, so more light is reflected back and less energy reaches the Earth surface. This takes place during very large volcanic eruptions such as Pinatubo in 1991, which lowered the temperature for

some five years by at most 0.5 degrees C. The method was proposed by Budyko in 1974 and would mean injecting millions of tons of SO₂ into the stratosphere, each year.

Space-based methods aim at putting lenses, mirrors or clouds of dust in space so as to deflect or diffuse solar radiation before it reaches Earth.

The Royal Society proposed four criteria for assessment of each geoengineering technology:

1. Effectiveness: including confidence in the scientific and technological basis, technological feasibility, and the magnitude, spatial scale and uniformity of the effect achievable.
2. Timeliness: including the state of readiness for implementation (and the extent to which any necessary experiments and/or modelling has been completed), and the speed with which the intended effect (on climate change) would occur.
3. Safety: including the predictability and verifiability of the intended effects, the absence of predictable or unintended adverse side-effects and environmental-impacts (especially effects on inherently unpredictable biological systems), and low potential for things to go wrong on a large scale.
4. Cost: of both deployment and operation, for a given desired effect (ie for CDR methods, cost per GtC, and for SRM methods, cost per W/m²) evaluated over century timescales (later also expressed as its inverse, ie affordability). In practice, the information available on costs is extremely tentative and incomplete, and only order-of-magnitude estimates are possible.

These criteria are still useful, but should be compared to a default, such as coal power replaced by wind, solar or efficiency.

Fossils-to-RE is effective, can be done fast, has very few safety issues, and is cheap.

It should also be noted that SRM must beat fossils-to-RE on all four criteria. It is

not a question of weighted average. You cannot have it if it is cheap but dangerous, or if it is deemed to be effective, safe and timely, but costs much more than shutting down a coal power plant and building PV per tonne of CO₂ avoided.

It is indeed hard to see how any proposed SRM technology could pass this screening process. Most of the SRMs are irresponsible and ill-founded, and not worthy of serious consideration.

However, highly respected scientists have argued for geoengineering either as a last resort or as a faster and more effective way to deal with warming than emission reductions.

Stephen Schneider 1996:

“Supposing a currently envisioned low-probability but high-consequence outcome really started to unfold in the decades ahead (for example, 5°C warming in this century) which I would characterize as having potential catastrophic implications for ecosystems... Under such a scenario, we would simply have to practice geoengineering ...”

Paul Crutzen 2006:

“Reductions in CO₂ and other greenhouse gas emissions are clearly the main priorities. However, this is a decades-long

process and so far there is little reason to be optimistic.”

Lord Rees of Ludlow, President of the Royal Society in the foreword to the Society’s report on geoengineering in 2009:

“But if such reductions achieve too little, too late, there will surely be pressure to consider a ‘plan B’ – to seek ways to counteract the climatic effects of greenhouse gas emissions by ‘geoengineering’.”

The term geoengineering and the concept of solar radiation management go back to the early 1970s and to still earlier efforts at weather modification for military or other reasons.

This long history is important for two reasons. One predominant idea of the postwar decades was that scientists can predict and control anything, given enough resources. Another common belief was that economic growth inevitably leads to more CO₂ emissions.

Weather and climate modelling was first developed with the early computers in the 1940s and 1950s. The scientific community, having developed the atomic bomb and the hydrogen bomb, were clearly overconfident. John von Neumann, the computer pioneer who was dubbed “the smartest man on earth”, worked on weather

modelling. He believed that there were two kinds of weather, stable and unstable, and that all that was needed was bigger computers:

“All processes that are stable we shall predict. All processes that are unstable we shall control.”

He imagined that we needed only to identify the points in space and time at which unstable processes originated, and then a few airplanes carrying smoke generators could fly to those points and introduce the appropriate small disturbances to make the unstable processes flip into the desired directions. “A central committee of computer experts and meteorologists would tell the airplanes where to go in order to make sure that no rain would fall on the Fourth of July picnic.”

In 1963, Edward Lorenz showed that predictability is very limited. If the input data is changed a tiny bit, the result (weather) can change completely.

Though weather and climate are not the same thing, they have similar flipping points. But Lorenz’s article went unnoticed for more than a decade.

Some people, especially those whose scientific roots stretch a long way back, still believe we can control the weather or the climate.



Solar radiation management...

Continued from page 25

Another aspect of this long history is that by the 1970s, much of the scientific community actually saw global warming as a potential menace, though the general public was unaware of it. Because the global warming theory was not corroborated by actual temperature data, there was not much sense of urgency.

At that time economic growth was seen as inextricably linked to primary energy growth, through growth in transport, electricity demand and industrial output. Some of this growth was expected to be met by nuclear power, including fast-breeder reactors and fusion power.

Wind power did not exist, solar photovoltaic was extremely expensive, other renewable energy looked limited (hydro, biomass) or not very good (solar thermal, geo-thermal, electric cars). Nobody considered radical efficiency improvement an option.

The conventional wisdom was that economic development would lead to very much increased CO₂ emissions for a very long time. An eventual Peak Oil would be met with coal liquefaction and tar sands. This view was common in developed countries, the third world and the Soviet Union.

This mindset did not change fast.

Even though climate change entered the international political agenda in 1987, emissions largely kept climbing.

In 1997, the year of the Kyoto protocol, the renowned physicist Edward Teller and the chief physicist at Lawrence Livermore national laboratory claimed that actually cutting emissions would cost more than \$100bn/year, whereas for less than one per cent of that cost, warming could be “obviated” by sending millions of tons of sulphate or alumina aerosols into the stratosphere.

The decoupling of growth and emissions was not very apparent by 2008–2009, when the Royal Society revived geoengineering, first with a theme journal issue on the subject in 2008, and then with a report entitled *Geoengineering the climate: Science, governance and uncertainty* in September 2009.

This in turn led in 2010 to the formation of the Solar Radiation Management

Governance Initiative (SRMGI), “an international, NGO-driven project that seeks to expand the global conversation around the governance of SRM geoengineering research”.

SRMGI does “not take a position on how SRM should be governed or whether it should ever be used”, but it provides an important platform for those who want to keep SRM as an option. (Those who are opposed to geoengineering for whatever reason are not interested in expanding the global conversation about it.)

The idea that geoengineering would be easier and cheaper than reducing emissions was being questioned by 2010, but the strongest evidence for the viability of GHG cuts is even more recent.

It is a different world now compared to 2007. It is not only conceivable that substantial GHG reductions can take place. It is a fact.

This was achieved during a period of economic growth, and without trying very hard.

Even more noteworthy is that China, after a long period of dramatically growing CO₂ emissions, more or less stabilised its emissions in 2013–2017, with growth of just 0.3 per cent over four years.

This is not a question of low-hanging fruit, but of general, affordable methods with a very large remaining potential. For example, solar and wind are rolling out very fast, in richer and poorer countries:

Issues with Solar Radiation Management:

- SRM addresses the wrong problem. The problem with climate change is not just that the average global temperature is rising. Redistribution of local and regional weather patterns can be disastrous for people and nature even if it does not influence the global average. Increased droughts and deluges do not cancel each other out.
- SRM and other engineering is a Plan B, but a Plan B is not required if we focus on Plan A. There is now growing optimism that 2 degrees and 1.5 degrees can be achieved this way.
- SRM leaves a number of important issues unattended. The problems caused by burning fossil fuels are not limited

Table 1, CO₂ emissions, Mtons

	2007	2017	change %
US	5881	5088	-13
EU	4144	3542	-15

Table 2 Wind power generation, TWh

	2007	2017
US	35	257
EU	104	362
China	5	286
India	12	53

Table 3 Solar power generation, TWh

	2007	2017
US	1	78
EU	4	120
China	0.1	108
India	0.1	21

to CO₂ warming. They include ocean acidification, acid rain, black carbon emissions, N₂O, tropospheric ozone and methane emissions from the fossil fuel cycle, nitrogen eutrophication (terrestrial and aquatic), and health problems due to emissions of particles and mercury. Real CO₂ reduction reduces all such problems, but SRM does not. Some of the problems can be reduced with technical fixes (de-sulphurisation etc.) but SRM itself does not solve them. No fix exists for ocean acidification.

- SRM expresses the notion that we have to find new solutions – a kind of Manhattan Project or Apollo Project for the climate – rather than using available technology and policy measures, just more and faster.
- The notion that brand-new solutions are needed may be attractive to billionaires who want personal credit for saving the world, sometimes in tandem with a media that is drawn to individual heroes. But it is the less glamorous collective national and international effort that can do the job, as they represent far more knowledge, resources and tenacity.
- SRM shifts attention from real GHG cuts, which represent a faster, surer, safer and more permanent way to mitigate climate change.
- SRM creates false hope for the fossil fuel industry, and could delay its decline or transition.

Solar Radiation Management experiments underway

Stratospheric injection in Arizona

The Stratospheric Controlled Perturbation Experiment (SCoPEx) will spray small amounts of water, chalk powder and sulphate particles into the stratosphere from a balloon to investigate how much sunlight will be blocked, as measured from the same balloon.

According to the SCoPEx team:

The ETC group claims that SCoPEx is against the 2010 moratorium on geoengineering activity under the Convention on Biological Diversity, and that experiments “would legitimize geoengineering and move us one step closer to a global sun-block”.

The SCoPEx team denies this.

The release of less than 1 kg of calcium

carbonate into the air is indeed unlikely to have any actual effect on biodiversity. But it is not motivated by pure research:

“Why conduct the experiment?”

This experiment will help us learn more about the efficacy and risks of solar geoengineering.”

Whether this experiment will infringe the Convention on Biological Diversity will not be looked into, as the United States, almost alone in the world, has not ratified the convention.

The funding of \$20 million comes from Harvard itself and from the privately funded Harvard’s Solar Geoengineering Research Program, which gets money from Bill Gates and several other philanthropists.

Research started in 2017 and field experiments are due in 2018.

Marine Cloud Brightening Project, Moss Landing, California

Aim: to test whether spraying a mist of sea water into clouds can make them whiter, eventually from ships. A previous larger-scale effort involving ten ships and 10,000 km² in 2010, by the same people, was abandoned after media reports made funders such as Bill Gates withdraw their support.

A land-based experiment is expected to go ahead in August 2018, but has been previously been delayed for years. It is a test of the spray nozzle technology that “will generate controlled volumes and sizes of tiny sub-micrometer seawater particles in sufficient numbers to increase the local brightness of low clouds in a marine environment”.

The budget is said to be \$16.3 million, but the project’s web page has no information on funding.

“Senior scientists” for the project are Paul Crutzen, who won a Nobel prize for work on

the ozone layer, and James Lovelock, the originator of the Gaia hypothesis. Two of the associated researchers are John Latham, the originator of the marine cloud brightening idea in 1974 and Ken Caldeira, who was a lead author for the IPCC and a personal favourite of Bill Gates.



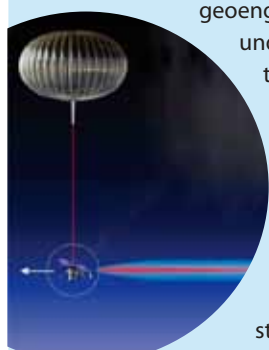
Protecting the Arctic by covering it in sand.

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Ice 911 project: small glass bubbles of arctic ice

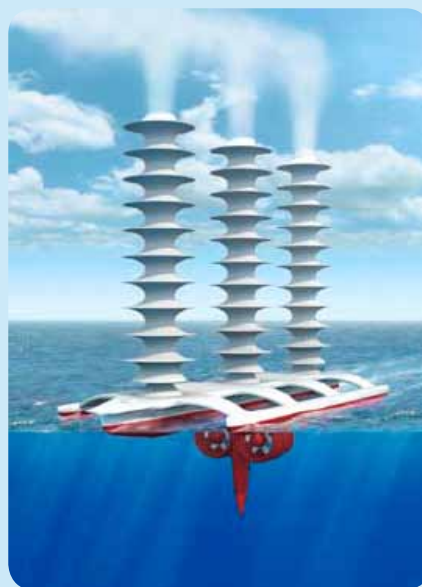
This project proposes to “preserve Arctic ice by spreading our eco-friendly sand ... protecting the ice below”.

The project hopes to “deploy a medium-scale test area of our material solution on Arctic ice, where our material can have the greatest impact on saving ice and lowering the risks of climate change” by 2019, and conduct a large-scale launch in the Fram Strait or Beaufort Gyre the next year.



JOHN A. DYKEMA ET AL. CC BY

The idea is to spray particles into the stratosphere to block sunlight.



RESEARCHGATE.NET/J. MACNEIL CC BY

An artist's conception of a ship designed to spray saltwater into the air for marine cloud brightening.

- The modelling of chaotic systems will remain imperfect. Unforeseen consequences of human intervention in the climate and weather systems are to be expected.
- SRM increases international tensions, because it changes precipitation patterns, which may mean that there are winners and certainly losers. More rain, and better harvests in one country may

- lead to droughts in another country.
- SRM experiments and deployment could undermine the 1977 Environment Modification Convention.
- Allegations of foul play are hard to confirm or disprove. Accusations, justified or not, can cause diplomatic crises.
- SRM could be “weaponized”, for example in an effort to change battlefield conditions or to starve an enemy population.

- Some of the techniques discussed are not easily reversible, since a “termination shock” – a sudden rapid warming – may take place if a measure such as stratospheric injection is discontinued for whatever reason (international conflict, economic crisis).

Fredrik Lundberg

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Recent publications from the Secretariat

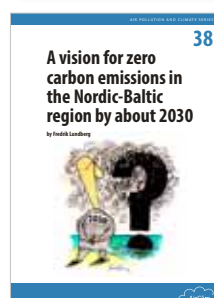
Reports can be downloaded in PDF format from www.airclim.org



The Greenhouse Effect, Global warming and Implications for Coral Reefs (March 2018). By Lennart Nyman. Tropical coral reefs harbor some 25 per cent of all marine species.



Cost-benefit analysis of NOx control for ships in the Baltic Sea and the North Sea (April 2017). By Katarina Yaramenka, Hulda Winnes, Stefan Åström, Erik Fridell.



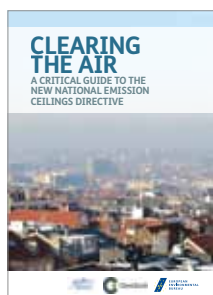
A vision for zero emissions in the Nordic-Baltic region by about 2030 (March 2018). By Fredrik Lundberg. A scenario for the electricity, heat and industrial sectors.



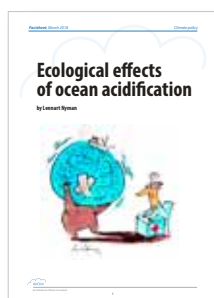
Paths to a sustainable agricultural system (Dec 2017). By Johan Karlsson et al. Exploring ways for sustainably feeding the Nordics.



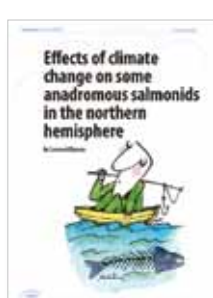
What will it take to phase out greenhouse gas emissions from road traffic in the Nordic-Baltic region by 2030-2035? (March 2018). By Mats-Ola Larsson. A conceivable scenario.



Clearing the air (Feb 2017). A critical guide to the new National Emissions Ceilings directive.



Ecological effects of ocean acidification (March 2018). By Lennart Nyman. By absorbing CO₂ the ocean is becoming more acidic, and this happens at a rate faster than any period in the past 300 million years.



Effects of climate change on some anadromous salmonids in the northern hemisphere (March 2018). By Lennart Nyman. Some direct impacts on salmon can be predicted.

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Coming events

IMO MEPC 73 (Marine Environment Protection Committee). London, UK, 22 - 26 October 2018. Information: www.imo.org

WHO First global conference on air pollution and health. Geneva, Switzerland, 30 October - 1 November 2018. Information: <http://www.who.int/airpollution/events/conference/en/>

The European Diesel Summit - Fast routes to clean air. Brussels, Belgium, 6 November 2018. Information: <https://www.transportenvironment.org/events/european-diesel-summit-fast-routes-clean-air>

10th Better Air Quality Conference. Kuching, Malaysia, 14 - 16 November 2018. Information: <http://baqconference.org>

System change or technological solutions – Climate change mitigation under the new CAP. By BirdLife & EEB. Brussels, Belgium, 21 November 2018. Information: <https://ec.europa.eu/eip/agriculture/en/event/system-change-or-technological-solutions-climate>

How a bill becomes a better CAP. By NABU, Birdlife & EEB. Brussels, Belgium, 22 November 2018. Information: <https://docs.google.com/forms/d/e/1FAIpQLSc3pkAc8C05z59tPCLz68etSKkthMOF57D7tuzGkqP9NNxoLA/viewform>

2018 Polis Conference on "Transport innovation for sustainable cities and regions". Manchester, UK, 22-23 November 2018. Information: www.polisnetwork.eu/2018conference

UNFCCC Second sessional period in 2018; COP 24. Katowice, Poland, 3 - 14 December 2018. Information: <http://unfccc.int/>

Clean Air for All: Stepping up joint efforts to fight air pollution in Europe. Brussels, Belgium, 5 December 2018. Information: <http://www.publicpolicyexchange.co.uk/events/IL05-PPE2?ss=em&tg=1a>

CLRTAP Executive Body. Geneva, Switzerland, 10 - 13 December 2018. Information: www.unepce.org/env/lrtap/welcome.html

EU Environment Council. Brussels, Belgium, 20 December 2018. Information: www.consilium.europa.eu/en/press/calendar/

IMO PPR 6 (Sub-Committee on Pollution Prevention and Response). London, UK, 13 - 17 May 2019. Information: www.imo.org

IMO MEPC 74 (Marine Environment Protection Committee). London, UK, 13 - 17 May 2019. Information: www.imo.org

23rd International Transport and Air Pollution (TAP) Conference. Thessaloniki, Greece, 15-17 May 2019. Information: www.tapconference.org