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## Flemish Green Deal on domestic wood heating

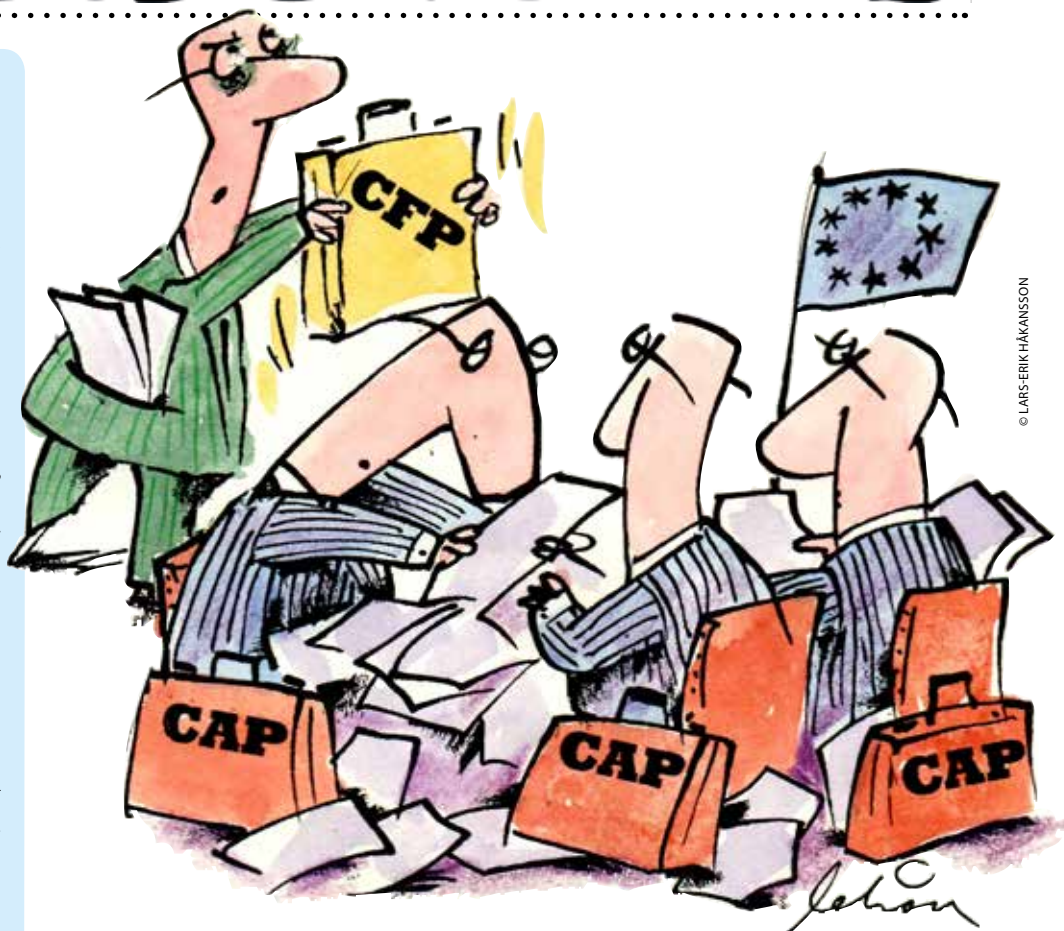
An accelerated replacement or phasing out of old wood-fired heating devices can bring significant additional reductions in PM<sub>2.5</sub> emissions.

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The air we breathe could be changing our behaviour in ways we are only just beginning to understand.

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# A first vision of a Common Food Policy

IPES-Food presents a plan to transform the European Union food system, including proposals for 80 policy reforms and a new governance architecture.

**In February** the International Panel of Experts on Sustainable Food Systems (IPES-Food) published the report “Towards a common food policy for the European Union”. It is an ambitious piece of writing in which, following a consultation process with stakeholders, they propose 80 policy reforms that together would contribute to “address climate change, halt biodiversity loss, curb obesity, and make farming viable for the next generation”.

As the title hints, they suggest an overarching Common Food Policy in contrast to the existing Common Agricultural

Policy (CAP). Olivier De Schutter, IPES-Food co-chair and lead author, said: “A Common Food Policy can spark a whole sale transition to sustainable food systems in a way that the CAP, as a Common Agricultural Policy, cannot.”

They set five objectives for a Common Food Policy:

- Ensuring access to land, water and healthy soils
- Rebuilding climate-resilient, healthy agro-ecosystems
- Promoting, healthy and sustainable diets for all

# 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

**The drought in** Northern Europe last summer was a climate wake-up for many of us living in the region. It is one thing to grasp the basic science behind global warming and realise that things are going in the wrong direction, and another to experience it with your own senses. See the bone-dry fields, feel the sweat on your forehead and smell the smoke from forest fires.

The climate debate intensified during the autumn. Not least as it was embodied by the fifteen-year-old activist Greta Thunberg, who began her own school strike outside the Swedish

parliament in September. A strike that has inspired youth in several European countries to mass actions. In some member states this was reflected in the European Parliament elections. In Germany, Ireland and Lithuania, the green parties grew stronger. Though in too many countries this was not the case.

A paradigm shift is needed. But the concept of transformative change is a bit like the concept of global warming, most of us can understand it on some basic level. Things need to be different from now on. We cannot continue like this. But we also need concrete plans for what really needs to be done.

**Scenarios, like the** ones described on page 4, are one way to realise a vision of a different future. Through modelling, we can explore plausible pathways and find out what options actually are available and what trade-offs they bring and must therefore be addressed.

The IPES-Food report (front page) is another example of the work needed, not just suggesting modifications to existing policy, but sketching out a new policy

architecture for our food system. The Common Agricultural Policy has been reformed many times since it was first introduced in the 1950s, but it is still a product of

post-World-War-II thinking, when the focus was on keeping production levels up and ensuring that the population had enough to eat. In this era of obesity, biodiversity loss and the risk of run-away climate change, our priorities are different and we will need new frameworks that reflect these new priorities. There is a greater need for cross-sectoral cooperation that gives health and environmental concerns a greater

influence on food production. Different people need to be involved in the policy process.

**Summer is approaching** fast. Farmers and many others fear a repetition of the last one. But we already know that extreme weather will become more common and that annual variations in weather will persist, so this summer could just as well turn out to be cold and wet. Regardless, we are still in a situation where climate change is heading towards climate crisis.

Whether summer is spent in the shade with a cool drink trying to survive a heat-wave, or curled up in front of a fireplace with the rain lashing down outside, it will be an opportunity to close your eyes and reflect. We need system change. But it is not going to happen without ordinary people like you and me being able to visualise a different future and taking the next steps.

Kajsa Pira

**“In this era of obesity, biodiversity loss and the risk of run-away climate change, our priorities are different”**



# A first vision of a Common Food Policy

*Continued from front page*

- Building fairer, shorter and cleaner supply chains
- Putting trade in the service of sustainable development

The policy proposals that they put forward deal with a wide range of policy areas, since the food system is affected by agricultural, environmental and trade legislation. Some areas are covered by EU competence today, some are not.

Quite a few proposals address the current CAP. In the short term, they suggest to:

- Scrap coupled payments to livestock and allow them only for “nitrogen-fixing leguminous crops, permanent grasslands/pastures, fruit & vegetable production, and trees (agro-forestry)”
- Reform and expand the conditionality for direct payments (pillar 1) so it includes “specific clauses of Water Framework, Nitrates & Sustainable Use of Pesticides Directives” and trees as Landscape Features
- Dedicate at least half of EU CAP funding to Rural Development (pillar 2) and introduce an “agroecology premium” under pillar 2

In the medium and longer term, they propose to:

- Abandon the income-support logic and move all CAP payments to a single pillar where payments are based on public goods provision
- Phase out all coupled payments
- Introduce livestock density limits in line with the Organic regulation

Another area of concern is farm advisory services. Though they have great potential to spread knowledge about sustainable management, in many cases they are the same enterprises as those selling inputs to the farm. To ensure independence and quality they should be certified at EU level. This also includes a short-term proposal to promote environmentally friendly practices, for example sustainable soil management.

In the longer term, IPES call for an EU Soil & Land Directive. This is not too far-fetched, since a proposal for a Soil Directive was on the table back in 2014, but the Commission decided to withdraw it because of lack of support.

However, IPES also wants to include regulations for sustainable land development, as well as integrating new soil management requirements into CAP conditionalities.

There are also several policy proposals aimed at supporting a dietary shift towards a more sustainable diet. In the short term, they suggest to:

- Exempt fruit and vegetables from VAT
- Develop EU and national dietary guidelines for healthy and sustainable diets
- Ensure that public procurement supports sustainable farming and healthy diets

**In the longer term**, they argue that a reform of the CAP would make sustainable food cheaper and more accessible for everyone.

Some of the reforms are about streamlining other sets of policies so they also contribute to a sustainable food system, e.g.:

- Make access to EU Structural Funds conditional on sustainable land use under integrated territorial food system planning
- Introduce sustainability criteria (incl. biodiversity and climate indicators) for EU aid and investment flows, including EIP
- Introduce CO<sub>2</sub> tax (border adjustment) and exclude high-GHG goods from liberalisation
- Explore a sustainable development clause and/or a Climate Change Waiver within WTO Agreements

The report also highlights the need to challenge existing power structures, and Olivier De Schutter explains that “the most ambitious reforms — the reforms we most urgently need — will only become viable on the basis of reclaiming decision-making processes from powerful lobbies, bringing new actors around the table, shaping policies in more democratic ways, and allowing new priorities and new coalitions of interest to emerge.”

To give sustainable food systems greater priority they suggest to:

- Dedicate one of the vice-presidents’ positions in the European Commission to sustainable food systems
- The European Parliament should form a formal intergroup on food. An inter-



group is a forum for MEPs to exchanges of views on particular subjects and promote contacts between MEPs and civil society

- The European Political Strategy Centre (EPSC), which is the European Commission’s in-house think tank, should develop a “Sustainable Food Taskforce” with the purpose of setting a long-term vision for the European Commission
- Appoint a “head of food” in each of the DGs (departments of the European Commission), in order to break the current silo-thinking

They also stress the need for stakeholder engagement in the policy process and suggest a “European Food Policy Council” and “participatory process for assessing technological innovations”.

“Ultimately, this report is a call to action,” De Schutter concludes, calling on the European institutions to take on the challenge of working with all food system actors to complete, adopt, and implement a food policy for Europe. “The Common Food Policy offers a Plan B for Europe: a way to reclaim public policy for the public good and to rebuild trust in the European project.”

Kajsa Pira

“Towards a common food policy for the European Union” by IPES-Food: <http://www.ipes-food.org/eu-common-food-policy>

The International Panel of Experts on Sustainable Food Systems (IPES-Food) was established in 2016. It is an independent think-tank that brings together expert voices from different disciplines and different types of knowledge to inform the policy debate on how to reform food systems across the world.

# In pursuit of net-zero farming

Slashing agricultural greenhouse gas emissions is a tricky balancing act: we will need to use all the tools available, while making sure we do not sacrifice other environmental interests along the way.

**Two recent reports** deal with the issue of aligning the agricultural sector with the target to achieve carbon neutrality in the European Union by 2050. First out was “Net-zero agriculture by 2050: How to get there”, by the Brussels based think tank, Institute for European Environmental Policy (IEEP). They start by giving a review of 60 existing scenarios from 18 different studies. Most of them achieve emission reductions in the range of 35–55 per cent by 2030 or 2050. In other words, far from a target of net-zero emissions.

Further, they note that there are some general alternatives available to achieve carbon neutrality for the agricultural sector:

1. Changing the way agricultural commodities are produced to increase the per unit greenhouse gas efficiency of production
2. Changing what the sector produces to move towards commodities that have a lower greenhouse gas footprint
3. Increasing the carbon sequestration potential on agricultural land

There is a risk that the positive impacts of the first approach could be offset by increased production, often referred to as the rebound effect or Jevons paradox. On

the other hand, the second approach must be followed by changes in consumption, otherwise there is a risk that carbon-intensive products will be imported from other parts of the world, resulting in carbon leakage.

In contrast to the other two approaches the third approach does not actually reduce greenhouse gas emissions, but rather the impact they have, by removing and storing carbon in the soil or in biomass. This approach includes different production practices that store more carbon in the soil, changes in agricultural systems e.g. from cropland to grassland and afforestation of previous agricultural land.

By combining these three alternatives in different ways they set up four scenarios:

- A. Efficiency improvements and carbon sequestration with no major land use changes (option 1 + option 3 light)
- B. Production changes and carbon sequestration with no major land use changes (option 2 + option 3 light)
- C. Efficiency improvements, production changes and carbon sequestration with no major land use change (option 1 + option 2 + option 3 light)
- D. Efficiency improvements, production changes and carbon sequestration with

major land use change (option 1 + option 2 + option 3 full)

The efficiency improvements included intensification of livestock production, increased crop yields of 30 per cent and improved waste collection (option 1). The production changes come with a 10 per cent reduction in calories, 75 reduction in meat consumption, and a lower share of bovine meat (option 2). Carbon sequestration in the first three scenarios implies that freed-up land is converted (option 3 light). In the final scenario, 80 per cent of freed-up land is turned into forest (option 3 full).

Scenario A had the lowest potential, with only 10 per cent emission reductions by 2050. Scenarios B and C were in the same range as most of the scenarios in the review, with 33 per cent and 46 per cent emission reductions by 2050. Scenario D was the only one that came anywhere close to the zero-emission target, with 80 per cent emission cuts. This indicates that using all tools available is the only way forward if the aim is carbon neutrality.

**Taking a different** starting point, namely that of agroecology, in a recent report the French research institute IDDRI also examines how agriculture can contribute to a carbon-neutral Europe by 2050.

Last year they launched a scenario called TYFA, which is an attempt to model a widespread adoption of agroecological practices across Europe, entailing a phasing-out of pesticides and synthetic fertilisers, and the redeployment of extensive grasslands and landscape infrastructure. This involves the adoption of “healthy diets”, which in this case means a drop in total calories by 6 per cent, slashing consumption of pork and poultry meat by almost two-thirds, and an increase in fruit and vegetable consumption by half.

However, this approach only leads to reductions in greenhouse gas emissions of around 40 per cent.

The institute also developed a scenario

## Agricultural emission reductions hierarchy

1. **Avoiding emissions where possible.** Changing the types of commodities produced, reducing the consumption of livestock and other carbon-intensive products, and eliminating food waste;
2. **Reducing emissions where they cannot be avoided.** Increasing the resource-efficiency of production, lowering the per-unit GHG emissions of a commodity, producing seasonally and in the most optimal conditions in Europe, and reducing harvesting waste;
3. **Recovery of emissions where possible.** Increasing the sequestration potential on land to build carbon sequestration into standard production practices and ensuring its continued and permanent management on agricultural land. Developing circular-bio-economies that recover post-consumption and production nutrients, energy and materials as inputs to the sector, reducing the need for new inputs. Future agriculture must be different from that of today, sufficiently transformed to enable its contribution to combatting climate change and the delivery of net-zero emissions, while providing adequate nutrition and other ecosystem services to an increasingly global society.





Turning grasslands into forest is an effective strategy to bind carbon, though not uncontroversial.

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that they call TYFA-GHG, in which the main assumptions are the same, but where they further reduce bovine numbers and allow for more biogas production. These two actions reduce emissions by a further 7 percentage points. This is still within the range of most scenarios in the IEEP review.

IDDRI argues that although their approach does not come close to carbon neutrality, it has several advantages. Measures included in the scenarios, such as eliminating pesticides, conserving semi-natural grasslands and setting aside land for agroecological infrastructures (hedgerows, grass strips, grasslands, thickets etc.) will all have a significantly positive contribution to biodiversity. They also assert that their low-tech scenario could increase adaptation capacity by increasing the level of diversity in agricultural landscapes and improving soil organic matter. They also dispute the potential for improvements

in efficiency that are assumed in several previous scenarios.

After reading these two reports, it is clear that there is currently no plan of action that shows how agriculture can be transformed to fit into a zero-carbon future. Nevertheless, steps need to be taken right now. The IEEP suggests an emission reductions hierarchy in an analogy of the waste reduction hierarchy (see box).

They also suggest that “the perceived high cost and ‘special nature’ of agriculture” that has so far been used as an argument against climate action in the sector should be reviewed. They add that in order for the agriculture sector to contribute to net-zero emissions by the middle of the century, it needs to be target driven. Policy should facilitate for farms to make a transition and make low-carbon choices a norm.

In line with the IDDRI concerns, they also call for the need to define “truly

synergetic measures that benefit both the climate and wider environmental goals” as well as developing “carbon farming schemes that build on results”.

They conclude that “transforming the sector will take time, requiring long-term investment and commitments at all levels”.

Kajsa Pira

“Net-zero agriculture in 2050: How to get there” by the Institute for European Environmental Policy (IEEP) <https://ieep.eu/publications/net-zero-agriculture-in-2050-how-to-get-there>

“Agroecology and carbon neutrality in Europe by 2050: what are the issues?” by Institut du Développement Durable et des Relations Internationales (IDDRI) <https://www.iddri.org/en/publications-and-events/study/agroecology-and-carbon-neutrality-europe-2050-what-are-issues>

# Phase-out of coal in Europe during 2019 is ongoing

Coal is being phased out in Europe, but not fast enough to get totally coal-free by 2025.

**Hard coal power** production decreased by 33 TWh (-9%) and lignite power by 8 TWh (-3%) in 2018, making a total of 41 TWh (-7%) according to preliminary data from Sandbag and Agora Energiewende.

This was not achieved by shifting to gas (-35 TWh), other fossil fuels (-3 TWh) or nuclear (-3 TWh). The fossil loss was made up for by an increase in hydro (+39 TWh) and other renewables (+35 TWh). Hydro variations between years are random, but other renewables represent a trend.

So coal is already going down. But if the present trend is maintained, 38 per cent of coal power will still be around by the end of 2025.

A recent AirClim report outlined a stepwise coal power phase-out to 2025 for Europe, i.e. EU-28, western Balkans and Turkey, from data in the Beyond Coal database.

Some things are moving in that direction, others not.

One way to measure progress is actual coal power production (in TWh, as above), another is looking at capacity additions or retirements, or announcements thereof, in MW.

Both are important. The TWh figures are closely related to emissions for that year, but there is a possibility that the

same capacity will produce more TWhs the next year, if it is not actually shut down for good.

If we look again at EU actual energy use, there is an encouraging overall picture. In Germany, the top coal user decreased its coal power use by 13 TWh, while Italy, Spain and the UK decreased energy use by 6 TWh each, France by 4 TWh, and Poland by 1 TWh. They are the six biggest members of the EU, and five of them (excluding Poland) have policies in place for phasing out coal and increasing renewables.

As for Germany, there is more recent data. The first four months of 2019 saw a further 12 TWh decrease in coal compared to the same period in 2018.

Germany has a de facto policy of coal phase-out by 2038, which has been universally denounced as far too late by all NGOs (and Greta Thunberg!).

The German coal phase-out Commission plan was published in late January 2019. Within three months RWE (the top fossil power company in Europe) gave in on its 1,100 MW Niederaussem lignite power plant.

"It took a while, but now RWE has realised that new coal-fired power plants in Germany no longer have a future,"

wrote Helmut Bänder in the Frankfurter Allgemeine Zeitung. "With the report of the coal commission...the project was not only economically but also politically finished."

Niederaussem had projected lifetime emissions of 178 million tons of CO<sub>2</sub>, and was one of only three future coal power projects in Germany. That is roughly the CO<sub>2</sub> emitted in 2017 from Iraq or Ukraine or the Netherlands.

Altogether the plans for coal in Europe as a whole shrank from 78 to 59 projects from early 2018 to April 2019: from 64.7 GW to 49.7 GW. The capacity under actual construction fell from 9 GW to 7.1, and plants currently open only slightly from 183 to 181.5 GW. The numbers include plants announced to retire, often soon, which totalled 9.6 GW in 2018 and 16.7 GW in spring 2019.

Most new coal power projects in Europe are in Turkey and the western Balkans. In Turkey, both capacity and actual coal energy went up in 2018 from 98 to 113 TWh.

The already bleak outlook for coal has become still darker during the last year. The EU CO<sub>2</sub> emission trading has been reformed and prices are up. Electricity prices are also up, but coal plants are

Country	Plant	fuel	status	start	end	announced	company	capacity, MW
UK	Cottam 1-4	hard coal	operational	1969	2019	07 Feb 19	EDF	2,184
Poland	Opole B1-B2	hard coal	operational	1994	2020	28 Mar 18	PGE	769
Netherlands	Hemweg 8	hard coal	operational	1995	2019	08 Mar 19	Vattenfall	685
Germany	Werne Gersteinw K2	hard coal	retired	1984	2019		RWE	666
UK	Fiddler's Ferry 1	hard coal	retired	1971	2019		SSE	533
Poland	Dolna Odra B1-B2	hard coal	standby	1974	2019	04 Jan 18	PGE	452
Czech Rep	Prunerov I3-I6	lignite	operational	1968	2020	27 Mar 19	CEZ	440
Poland	Belchatow B1	lignite	operational	1981	2019	28 Mar 18	PGE	370
Germany	Kiel East	hard coal	retired	1970	2019		Uniper	354
Spain	Alcudia II 1 GR I-II	hard coal	operational	1981	2019	12 Feb 19	Endesa	250
Finland	Kymijarvi 1	hard coal	retired	1982	2019		Lahti Energia	212
Poland	Siersza B6	hard coal	standby	1970	2019	04 Jan 18	Tauron	128
Poland	Stalowa Wola B8	hard coal	standby	1965	2019	04 Jan 18	Tauron	125
Poland	Siersza B3	hard coal	standby	1969	2019	04 Jan 18	Tauron	123





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Time to close the curtain for coal power.

losing the competition against everything else, especially old plants, particularly if they use extra-dirty fuels such as lignite, peat and shale.

Higher power prices favour solar and wind. They are now less vulnerable to unpredictable political changes, which have produced boom-bust cycles too many times in too many countries. In Sweden and Norway, the renewable certificate system is a minimal subsidy at about €1/MWh in futures trading, essentially nothing. Investment in wind power is still very high, so by 2022 there will be about 25 TWh more wind power than in 2018. Subsidy-free solar is reported from Germany and the UK, and subsidy-free offshore wind power from Denmark and the Netherlands.

Investment in renewables, storage and efficiency is without political risk, carries no technical risk, gives reasonably reliable payback, and is financeable. Investment or reinvestment in coal power is politically risky, and carries large uncertainties in carbon price, coal price, environmental legislation, legal risks, and it may not be easy to find a financier. Only nuclear is worse.

Here are the biggest retirements known so far for 2019 and 2020, many of which were announced during the first 3–4 months of 2019.

Fredrik Lundberg

Link to AirClim publication with proposal for phasing-out coal in Europe until 2025: <http://www.airclim.org/publications/phasing-out-coal-europe-2025>

# Western Balkans' chronic coal pollution

**Sixteen outdated coal** power plants in the Western Balkans are a public health and economic liability for the whole of Europe, with people in the EU bearing the majority of the health impacts and costs, according to a new report by environmental organisations.

Air pollution from old, inefficient and substandard coal power plants in the Western Balkans is responsible for an estimated 3,900 premature deaths every year. The health issues these plants cause result in lost productivity and health costs of up to EUR 11.5 billion/yr.

In 2016, 16 of these plants spewed out as much sulphur dioxide (SO<sub>2</sub>) pollution as all the 250 coal power plants in the EU. Levels for particulate matter and nitrogen oxides are equally alarming.

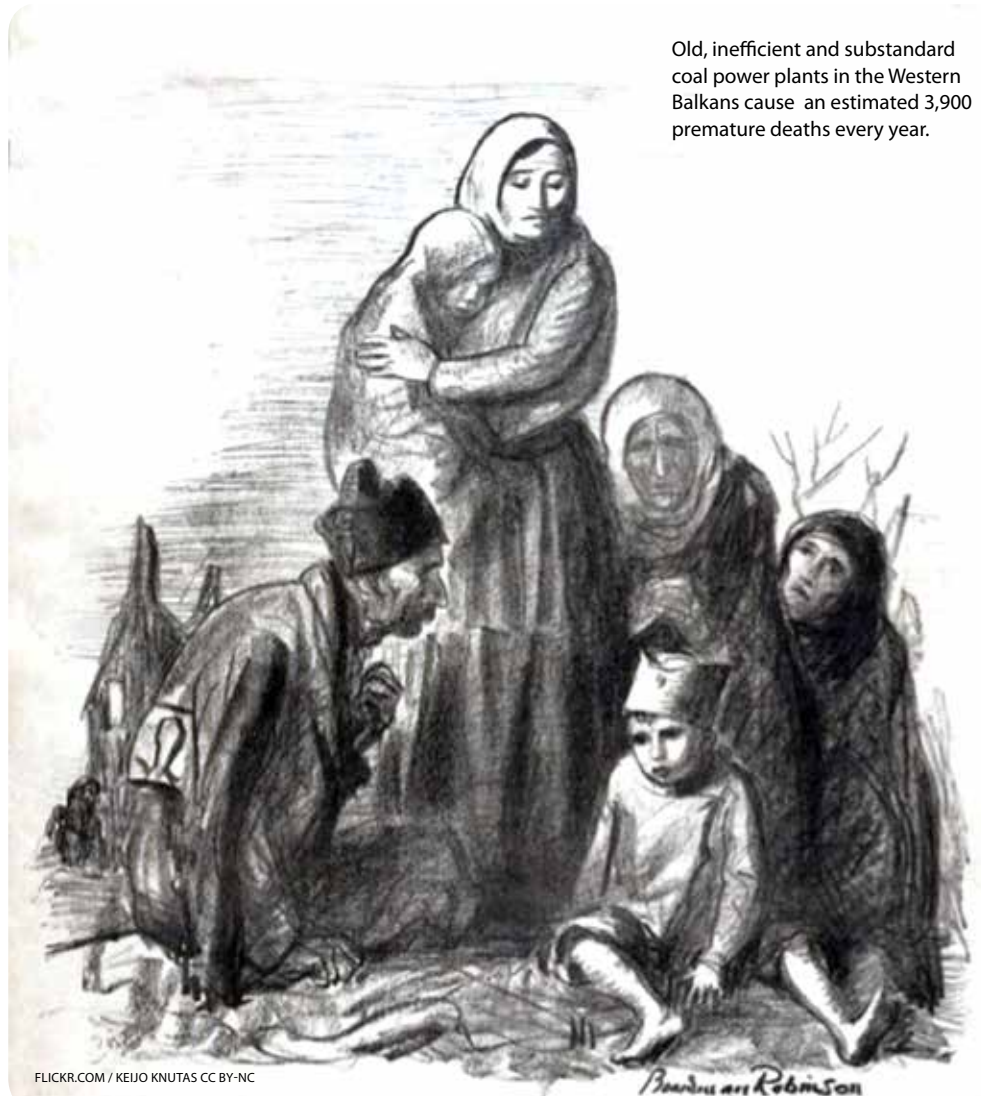
The Energy Community Treaty sets a deadline for Western Balkan countries to comply with EU pollution control

legislation by 2018. But meaningful action is still missing.

“It is in the interest of people across Europe – in the EU and the Western Balkan countries – to enforce Energy Community Treaty rules and to swiftly phase out this polluting, health-harming and outdated technology. Climate action, pollution control and air quality must also be prioritised in the EU accession process. As the EU moves to net zero greenhouse gas emissions, Western Balkan countries must also phase out coal, not just because it is a chronic air pollutant but also one of the biggest climate change culprits,” said Igor Kalaba at CAN Europe.

Source: HEAL press release, 18 February 2019. Link to the report: <https://www.env-health.org/wp-content/uploads/2019/02/Chronic-Coal-Pollution-report.pdf>

Old, inefficient and substandard coal power plants in the Western Balkans cause an estimated 3,900 premature deaths every year.



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Boardman and Robinson

# CCS: Time to move on

**With coal on the decline, for political, economic and technical reasons, the argument for CCS in the power sector is weaker than ever before.**

**Coal's days are** numbered and carbon capture and storage (CCS) isn't coming to save it. A November 2018 report by the Institute for Energy Economics and Financial Analysis (IEEFA) – “Holy Grail of Carbon Capture Continues to Elude Coal Industry” – shows that after more than a decade of effort and billions in public support, CCS has failed to advance much beyond the wishful thinking stage.

At the same time, coal's market share has declined as dramatically lower prices for renewable energy have made it increasingly difficult to compete in power markets across the globe. With coal increasingly in the rearview mirror in many countries, and the road ahead paved with wind turbines and solar panels, technologies like CCS are little more than a dead end for the climate.

**Ten years ago,** governments around the world were rushing to make CCS a reality to keep coal alive in a carbon-constrained world. A big push was underway in Europe, the US, and Australia for governments to provide funding and policy support for the technology. At the time, CCS wasn't yet viable and was very costly.

Governments needed to step in, the argument went, and give CCS a boost. Countries had no choice but to support the technology if they wanted to tackle climate change, proponents argued, because coal would continue to dominate the power sector for years to come. The promise from industry and CCS advocates was that if governments covered the cost of demonstrating CCS, and enacted enabling legislative frameworks, industry could commercialize the technology. In Europe, this conversation centered on the CCS Directive and an appeal for funding to support 10–12 demonstration projects, which would be operational by 2015.

A little more than 10 years later, coal is on the decline in many parts of the world and renewables are on the rise. And despite billions of dollars of public support, CCS

remains unproven at the commercial scale and extraordinarily expensive. After passing the CCS Directive (2009/31/EC) and spending almost €600 million, Europe has zero CCS demonstration plants.

IEEFA's report tracks four of CCS's highest profile failures in North America: Saskatchewan Power's Boundary Dam Power Station (Canada), NRG's Petra Nova project (Texas), Southern Co.'s Kemper plant (Mississippi), and Duke Energy's Edwardsport plant (Indiana). The report's lead author, David Schlissel, says that what these four projects have in common is “their dismal performance”. He characterizes the report's findings “as a cautionary tale for any country considering broad adoption of CCS for coal”.

Only two of the four projects profiled in the report are operational CCS facilities: Boundary Dam Power Station and Petra Nova. The report characterizes both as expensive demonstration projects. Boundary Dam is a post-combustion retrofit of a single coal-fired unit. Plagued by operational problems and cost overruns, the total cost of the project now stands at €980 million (US\$1.1 billion). The Petra Nova project, which cost about €890 million (US\$1 billion), is only managing to capture one-third of the flue gas from one of the four coal-fired units at the power station. Both projects rely on revenues obtained from selling captured CO<sub>2</sub> from enhanced oil recovery operations, which significantly undercuts (if not entirely negates) the emissions avoided from the capture operations.

The Kemper project, as described by the report, “is the poster child for projects gone wrong”. Kemper was slated to be a first-of-its-kind integrated gasification and combined cycle (IGCC) coal plant with a pre-combustion capture system. Initially estimated to cost \$3 billion, the price tag for the 830 MW facility ballooned to \$7.5 billion before being cancelled in 2017.

Kemper's poorly conceived project design meant the power station likely never would have been economic; simply running

the project's coal gasification and carbon capture systems would have consumed 30 per cent (250 MW) of the power station's gross output. The economic effects of Kemper as a failed CCS experiment will, unfortunately, be felt in Mississippi for years to come as that state's electricity ratepayers will be covering a portion of the project's cost due to the regulated nature of the electricity market.

Similar to Kemper, the Edwardsport plant was originally proposed as an IGCC coal-fired power plant with pre-combustion capture technology. However, after completing the plant in 2013, the power station's owners announced they would not install capture technology because it was too expensive. Even without capture technology, the power station has had issues and is operational only 57 per cent of the time. The power station's costs are also extremely high. Factoring in construction costs of \$3.5 billion for 618 MW of capacity, the all-in cost of the electricity from Edwardsport averages \$140.84/MWh. This is more than four times the average price of power in the local market and does not include any costs for carbon capture, transport, or storage.

**The IEEFA report** also discusses a critical aspect of CCS that receives scant attention: the pipeline infrastructure needed to compress, transport, and inject captured CO<sub>2</sub>. Assuming the cost and technical barriers associated with commercializing carbon capture technology were overcome, the infrastructure needed to move and inject captured CO<sub>2</sub> is, in and of itself, a substantial and costly barrier to the deployment of CCS. In the US, a pipeline network equal in size to the country's existing oil and gas pipeline system would be needed. Permitting, building, and financing such a network from scratch would be expensive and take years. The report notes there has been essentially no progress on CCS infrastructure issues over the last decade.

While CCS has largely been at a standstill for the past decade, the energy transition



CCS is compared to the holy grail. It is time to give up the fruitless search.



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away from fossil fuels is well underway thanks to competitively priced renewable energy; in some places, technologies like wind and solar are even cheaper than new natural-gas-fired power stations. The economic argument for renewable energy, perhaps more than anything else, means CCS has no role to play in the power sector as it will never be able to out-compete zero-carbon renewable energy technologies on price.

**Alongside economics, political** commitments have further decreased reliance on coal in favor of renewable energy. Countries such as France, Denmark, Finland, Sweden, Italy, Portugal, and the United Kingdom have committed to phase coal out altogether while others have set ambitious renewable energy targets that leave little to no room for fossil fuels in the power sector. An increasing number of corporations are powering their operations with 100 percent renewable energy, further

squeezing coal out of power markets in the US, Europe, and elsewhere.

With coal on the decline, for both political and economic reasons, the argument for CCS in the power sector is weaker than ever before. Spending billions more and another decade to advance a technology for a power sector which has the potential to be carbon-free without it, makes little sense. Nevertheless, some governments remain fixated on CCS and many continue to spend taxpayer money to support it.

In the eyes of some, CCS also remains a potential solution for industrial sector emissions and essential to so-called negative emission strategies (think: bioenergy with CCS or BECCS). The latter has gained substantial attention since the Paris Agreement increased the ambition on climate change by setting a long-term goal of limiting global average temperature increase to “well below” 2°C above pre-industrial levels and pursue efforts to limit

the increase to 1.5°C. These applications of CCS, however, face many of the same challenges as CCS in relation to coal-fired power plants.

With the renewed attention to CCS post-Paris Agreement, there is a risk of history repeating itself if the lessons learned in trying to make it work for coal are forgotten or ignored. As the IEEFA report demonstrates, CCS “remains unproven at full commercial scale, it is wildly expensive, [and] there are serious questions regarding after-capture transport, injection and storage of the captured CO<sub>2</sub> and – most important – more reliable and far cheaper power-generation options exist”.

Emily Rochon

She is a Brussels-based Lawyer (US qualified) and Energy Consultant and lead author of Greenpeace International's 2008 report on CCS – False Hope: Why carbon capture and storage won't save the climate?

# Sweeping Europe's emissions under the rug

Enthusiasm for CCS has waned across much of Europe as the technology has failed to advance and renewables have convincingly demonstrated their ability to cost-effectively decarbonize the energy system. But don't tell that to Norway.

**The country remains** firmly committed to proving CCS works. Norway's devotion to CCS is readily explained by the country's grand vision for the technology, which essentially boils down to Norway serving as the continent's carbon dioxide (CO<sub>2</sub>) emission repository and reaping significant financial benefits as a result.

Norway's most recent attempt to sell CCS to Europe is dubbed the Northern Lights initiative. Led by Equinor (formerly Statoil), Shell, and Total – with financial and political support from the Norwegian government – Northern Lights initially aims to inject carbon dioxide captured from two industrial facilities located in the south of Norway – a cement factory and waste-to-energy plant – under the North Sea. If successful, the Northern Lights initiative could be expanded to accept CO<sub>2</sub> emissions from industrial sources across Europe. A final investment decision on the project is expected in 2020/2021 with operations potentially commencing in 2024.

**Northern Lights is** Norway's second major effort to demonstrate the viability of CCS in support of its vision. The country's first flagship CCS project was Mongstad, a full-scale capture project

that would have collected CO<sub>2</sub> from a gas-fired combined-heat-and-power plant and oil refinery. The hype surrounding the Mongstad project was substantial – when announced in 2007 it was labelled by then-Prime Minister Jens Stoltenberg as Norway's "moon landing". But Mongstad was a bust. After delays and significant cost-overruns, Norway pulled the plug on the project in 2013.

As with Mongstad, Norway is once again peddling an overly optimistic assessment of what the project could deliver. Even at this early stage of development, Northern Lights faces significant economic and legal challenges. Northern Lights' business case, for example, entails collecting fees for transport and storage services to cover the project's costs. However, Norway doesn't generate enough CO<sub>2</sub> to make the project economic. The only way for Northern Lights to be economically self-sufficient is to import large volumes of CO<sub>2</sub> from facilities located in other countries.

The only problem with this plan is that transporting CO<sub>2</sub> from one country to another for storage is not permitted under international law. More specifically, Article 6 of the London Protocol prohibits contracting parties from exporting CO<sub>2</sub> for sub-seabed storage. Article 6 was amended in 2009 – under extreme pressure from Norway – to allow

such activities but the amendment has yet to be ratified by a necessary two-thirds of contracting parties. So far, only Norway, the United Kingdom, and the Netherlands have ratified the amendment. Another 28 countries will need to do so before it can take effect. This is highly unlikely in the short to medium term, which means Northern Lights will not have access to Europe's CO<sub>2</sub> emissions for the foreseeable future.

**Northern Lights' supporters** often make bold claims about the "practically unlimited" storage potential underneath the Norwegian North Sea that could store "all European emissions for hundreds of years". Some have even claimed the North Sea can store 1,000 years of emissions. These claims are proffered as proven facts but they are really only best guesses based on top-down assessments that tend to overestimate storage capacity because they do not account for actual pore space ability and varying characteristics across storage formations.

When such factors are evaluated, top-down capacity estimates are frequently revised drastically downwards. For example, Norway and CCS proponents were previously fond of claiming that the Utsira formation where the Sleipner CO<sub>2</sub> storage project operates had "practically unlimited" storage potential and could handle CO<sub>2</sub> emissions from "all power stations in Europe for the next 600 years". However, after an in-depth study, the Norwegian Petroleum Directorate downgraded the storage capacity estimate for the Utsira formation from "able to store all European emissions for hundreds of years" to "not very suitable".

**As with most** CCS projects, Northern Lights' ability to safely and permanently



Norwegian in a different reality than the rest of Europe.

ACID NEWS NO. 2, JUNE 2019

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store CO<sub>2</sub> is largely presumed. Concerns about safe storage are downplayed, with CCS proponents pointing to natural analogues as evidence that humans can permanently store CO<sub>2</sub> underground. Norway and others also tout the Sleipner project as proof of concept. Never mind that Sleipner, as well as other non-CO<sub>2</sub> storage projects in the Utsira formation, have experienced issues that call that claim into question.

A more sober assessment raises significant questions about the ability to ensure safe, permanent storage, and whether our regulatory frameworks can appropriately manage and allocate risk throughout every phase of a CO<sub>2</sub> storage project. The answer to many of these questions is we simply do not know. The world has limited experience with CO<sub>2</sub> storage (particularly sub-seabed) and we remain in the learning phase; our regulatory frameworks are largely untested; and monitoring technologies cannot track CO<sub>2</sub> or detect leakages to the necessary resolution.

One can also never eliminate the potential for human error in applying and enforcing regulatory frameworks and guaranteeing responsible management and oversight of CO<sub>2</sub> storage activities by private sector actors. Failures experienced at existing CO<sub>2</sub> storage projects, like Sleipner, demonstrate the potential for something to go wrong.

**The European Union** (EU) established “a legal framework for the environmentally safe geological storage” of CO<sub>2</sub> in 2009. Article 2 defines “environmentally safe” as “permanent containment of CO<sub>2</sub> in such a way as to prevent and, where this is not possible, eliminate as far as possible negative effects and any risk to the environment and human health”. In short, the EU’s CCS Directive creates a risk-based approach for CO<sub>2</sub> storage to prevent and eliminate environmental and public health risks as much as possible. This is a laudable goal but will be difficult to achieve in practice.

All member states have transposed the CCS Directive into national law. However, as of 2017, only 16 member states have done so in a manner that fully conforms with the Directive. To date, the Directive’s permitting framework for CO<sub>2</sub> storage has been infrequently used with a

handful of permit applications submitted to the Commission for review and only two storage permits issued.

It’s far too early to tell whether the EU’s regulatory framework for storage will work in practice over the long term. However, several ambiguities, vague language, potentially conflicting objectives in the Directive in combination with a lack of experience and technological limitations will complicate efforts to effectively implement the framework. For example:

1. **Leakage:** A consistent and appropriate definition for leakage is essential because it relates directly to other measures in the Directive, such as corrective measures, potential liabilities (including surrendering ETS allowances), and transferring storage site ownership. The Directive falls short on this front. Leakage is defined as “any release of CO<sub>2</sub> from the storage complex”. The term “storage complex” refers to “the storage site and surrounding geological domain which can have an effect on overall storage integrity and security”. These ambiguous definitions create several uncertainties, making it difficult to determine what actually constitutes leakage.
2. **Quantifying the risk of leakage.** Applying quantitative approaches to assess the risk of leakage is difficult due to wide ranges in key parameters, multiple methodological approaches, significant technical uncertainties, and the long timescales involved. Limited case studies and published literature exist to guide regulators and project operators in this exercise and assist with permitting decisions.
3. **Significant.** “Significant” appears in several important aspects of the Directive. For example, in Article 4, a storage site should only be permitted if “there is no significant risk of leakage, and if no significant environmental or health risks exist”. This language seems to be in conflict with the objective in Article 1 of preventing and eliminating any risk to the environment and human health. What’s more, “significant” is tied to one of the triggers for corrective measures and could be underprotective depending on how that language is applied to individual projects.
4. **Corrective measures.** The need for corrective measures requires the detection

of “significant irregularities” or leakages through monitoring approaches capable of detecting issues wherever they may occur. Previous experience with Sleipner and non-CO<sub>2</sub> storage projects in the North Sea demonstrate that modeling and monitoring regimes can fail to accurately predict CO<sub>2</sub> movement, prevent overpressurisation, detect fractures, and identify leakages. What’s more, corrective measures, such as relief wells, can take several months to deploy in the event of a catastrophic leakage.

5. **Financial security and funding mechanism.** Articles 19 and 20 rightly include provisions to ensure storage operations provide funding to maintain storage sites through their operation and post-closure phases. How much funding will be needed, however, is unknown. The risk of inadequate funding is significant with the industry lobbying for lower funding requirements.

**Northern Lights** is at least several years away from determining if the proposed storage location is practical, safe, and likely to be permitted. It remains to be seen if the project will ever get off the ground. But contrary to what Norway would have us believe, there’s no such thing as a safe bet when it comes to CO<sub>2</sub> storage. Measures can be taken to reduce overall risk, but the risk of leakage can never be eliminated.

Maintaining a healthy skepticism about the potential to permanently store gigatons of CO<sub>2</sub> is the prudent approach rather than giving into the unfounded optimism that CCS will solve Europe’s CO<sub>2</sub> problem. Even better is implementing solutions that avoid the need for CCS in the first place and ignoring the hype. We’ve been here before with CCS in Europe and it got us nowhere. Let’s not make the same mistake twice.

Emily Rochon

She is a Brussels-based Lawyer (US qualified) and Energy Consultant and lead author of Greenpeace International’s 2008 report on CCS – False Hope: Why carbon capture and storage won’t save the climate?



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Busy fighting  
climate change.

## We need to work less to tackle climate crisis

People across Europe will need to work drastically fewer hours to avoid disastrous climate heating unless there is a radical decarbonising of the economy, according to a study.

The research, from thinktank Autonomy, shows that workers in the UK would need to move to nine-hour weeks to keep the country on track to avoid more than 2°C of heating at current carbon intensity levels. Similar reductions were found to be necessary in Sweden and Germany.

The Guardian 22 May 2019

<https://www.theguardian.com/environment/2019/may/22/working-fewer-hours-could-help-tackle-climate-crisis-study>

## GHG and ammonia emissions from Irish farms on the rise

According to the national Irish farm survey, based on data from 2017, emissions of greenhouse gases and ammonia continue to increase over time. Despite improvements in efficiency, that means less carbon and ammonia emissions per unit of product. This is however offset by growth in production.

Agriculture is the largest contributor to Irish greenhouse gas emissions, ac-

counting for 33 per cent of the national emissions total in 2017. Ammonia emissions from agriculture come mainly from animal waste and the spreading of synthetic fertilisers, and account for close to 99 per cent of Ireland's total emissions.

Green news Ireland, 26 March 2019 <https://greennews.ie/ghg-and-ammonia-emissions-rise-as-farms-expand-says-teagasc/>

Efficiency improvements are offset by increase in production.



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# 1.5-degree lifestyles

A new report “1.5-Degree Lifestyles” evaluates the implications of the Paris Agreement from a lifestyle perspective. It analyses scientific emission scenarios and case studies from Finland, Japan, China, Brazil and India, and proposes long-term targets for individuals' lifestyle carbon footprints by 2030–2050, as well as low-carbon options that citizens and society can adopt.

Considering current consumption levels, citizens in many developed countries would have to cut their lifestyle carbon footprints by about 80–90% or more, and some in developing countries by about

30–80% within the next 30 years. The largest changes will need to happen in the developed countries within the next decade. The range of footprint reductions required in this region for 2030 are at least 47% in food, 68% in housing, and 72% in mobility.

Michael Lettenmeier, one of the authors of the report from Aalto University, commented that “while doing this research we were surprised to note what a small role lifestyles had played in most existing scenarios on greenhouse gas emissions. Lifestyles can and must contribute to climate change mitigation, but not only

households must act. Governments and businesses have to facilitate lifestyle changes by providing infrastructure, products and services that enable households to live more sustainably. These changes have to be initiated now because lifestyle carbon footprints have to drop far below half in the course of one decade in order to keep global warming within 1.5 degree.”

“1.5-Degree Lifestyles: Targets and Options for Reducing Lifestyle Carbon Footprints” by the Institute for Global Environmental Strategies, Aalto University, and D-mat Ltd. [https://pub.iges.or.jp/system/files/publication\\_documents/pub/technical-report/6719/15\\_Degree\\_Lifestyles\\_MainReport.pdf](https://pub.iges.or.jp/system/files/publication_documents/pub/technical-report/6719/15_Degree_Lifestyles_MainReport.pdf)

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Carbon footprint from mobility needs to decrease by at least 72 per cent by 2030 in developed countries.





# Air pollution death toll much higher than previously thought

Air pollution causes nearly 800,000 early deaths a year in Europe and 8.8 million worldwide, according to a study published in the *European Heart Journal*.

**Using new hazard** ratio functions to calculate the effects on death rates due to ambient air pollution in the form of tiny particles (PM<sub>2.5</sub>) and ground-level ozone, researchers have found that air pollution caused an estimated 790,000 extra deaths in the whole of Europe in 2015, of which 659,000 in the 28 member states of the EU. Between 40 and 80 per cent of these premature deaths were due to cardiovascular diseases (CVD), such as heart attacks and stroke. Air pollution caused twice as many deaths from CVD as from respiratory diseases.

Globally, outdoor air pollution was estimated to cause an estimated 8.8 million extra deaths in 2015, nearly double the previously estimated 4.5 million. This means that air pollution is responsible for 120 extra deaths per year per 100,000 of the population worldwide. In Europe and the EU-28, it is even higher, causing 133 and 129 extra deaths a year per 100,000 people, respectively.

Looking at individual countries, air pollution caused an excess death rate of 154 per 100,000 in Germany (a reduction in mean life expectancy of 2.4 years), 150 in Poland (2.8 years), 136 in Italy (1.9 years), 105 in France (1.6 years), and 98 in the UK (1.5 years). Excess death rates were particularly high in eastern European countries, such as Bulgaria, Croatia, Romania and Ukraine, with over 200 each year per 100,000 of the population.

Professor Jos Lelieveld of the Max-Planck Institute in Mainz, Germany, and co-author of the study, said: "The high number of extra deaths caused by air pollution in Europe is explained by the combination of poor air quality and dense population, which leads to exposure that is among the highest in the world."

The researchers say that national governments and international agencies must take urgent action to reduce air pollution, including re-evaluating legislation on air quality and lowering the EU's current air

quality standards to match the World Health Organisation's guidelines.

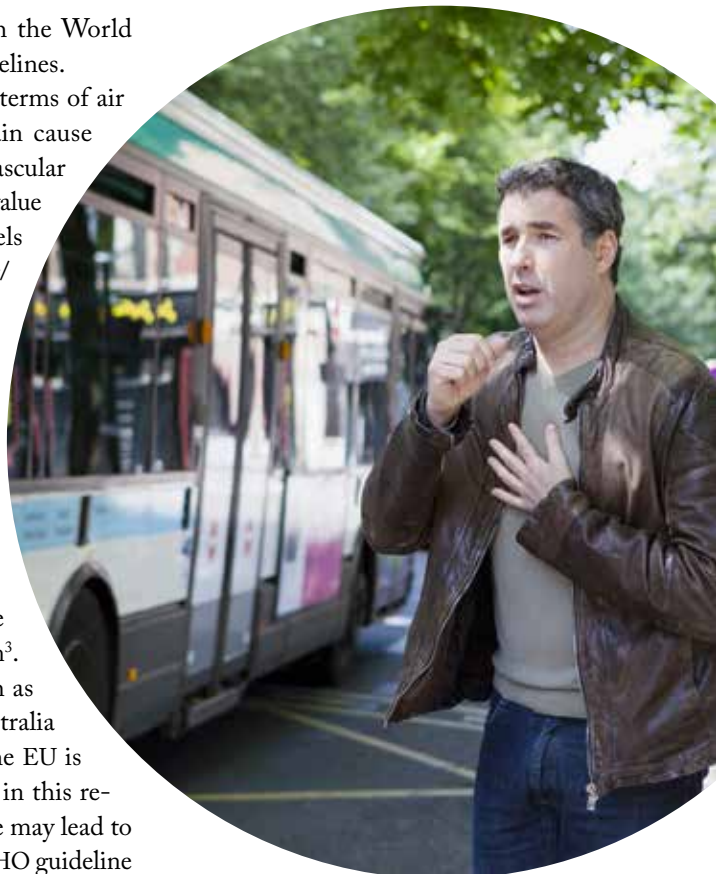
It is emphasised that, in terms of air pollution, PM<sub>2.5</sub> is the main cause of respiratory and cardiovascular disease. Currently, the limit value set for average annual levels of PM<sub>2.5</sub> in the EU is 25 µg/m<sup>3</sup> (micrograms per cubic metre), which is 2.5 times higher than recommended by the WHO.

Co-author Professor Thomas Münzel of the University Medical Centre Mainz, said: "The current limit of 25 µg/m<sup>3</sup> should be adjusted downwards to the WHO guideline of 10 µg/m<sup>3</sup>. Many other countries, such as Canada, the USA and Australia use the WHO guideline; the EU is lagging a long way behind in this respect. Indeed, new evidence may lead to a further lowering of the WHO guideline in the near future."

**Replacing fossil fuels** by clean, renewable energy sources is a key measure to reduce air pollution. Prof Lelieveld said: "Since most of the particulate matter and other air pollutants in Europe come from the burning of fossil fuels, we need to switch to other sources for generating energy urgently. When we use clean, renewable energy, we are not just fulfilling the Paris agreement to mitigate the effects of climate change, we could also reduce air pollution-related death rates in Europe by up to 55 per cent."

According to Prof Lelieveld, the levels of PM<sub>2.5</sub> in the air could be reduced further by limiting agricultural emissions, which are responsible for a comparatively large amount of particulate matter pollution and for the associated extra number of deaths in Europe.

He said: "In Germany, for instance, agriculture contributes up to 45 per cent of



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Currently, the limit value set for average annual levels of PM<sub>2.5</sub> in the EU is 25 µg/m<sup>3</sup>, which is 2.5 times higher than recommended by the WHO.

PM<sub>2.5</sub> to the atmosphere. When manure and fertiliser are used on agricultural land, ammonia is released into the atmosphere, which reacts with sulphur and nitrogen oxides and associated sulphuric and nitric acids, forming salts such as ammonium sulphate and nitrate. These substances contribute significantly to the formation and composition of fine particles, interacting further with soot and organic aerosol compounds."

Christer Ågren

The study "Cardiovascular disease burden from ambient air pollution in Europe reassessed using novel hazard ratio functions", by Jos Lelieveld, Thomas Münzel et al. Published in the *European Heart Journal*. doi:10.1093/eurheartj/ehz135.

Source: European Heart Journal press release, 12 March 2019.



# Large potential for offshore wind energy in the Baltic and North Sea

Low-cost renewable electricity shows that climate-protecting measures may improve industrial competitiveness and prosperity.

**While ABB was** still busy trying to sell nuclear reactors, coal-fired power plants and various large turbines for hydro and gas power plants, there was an engineer who had a different idea. Gunnar Asplund was heading development at ABB Power Systems in Ludvika, Sweden and designed a vision for a 100-percent renewable electricity system for Europe: 700 GW of solar electricity mainly in southern Europe and northern Africa, 300 GW of wind power mainly in the North Sea, the Baltic Sea and west of France. 200 GW of hydro power, 1,000 TWh of energy storage and a lot of high-voltage transmission lines made up his vision.

When this vision began to spread on an ABB-branded slide in 1992 it was not appreciated by everyone at ABB. What was wrong with all the fantastic power plants ABB had already supplied, some asked. The vision could “upset” existing key customers and spread the notion that ABB was not a serious company.

Others, including most economists at the time, dismissed the vision as economically impossible. Among the electric power companies, renewable energy was rejected as too expensive, “intermittent” and not up to normal standards, and the distributed power plants did not fit the business models of 20th century power companies anyhow.

At that time the economic arguments seemed strong: solar and wind power cost several times as much per kWh as conventional thermal nuclear or thermal power plants. But Asplund was an engineer. He did not look at current prices at the time, but at what skilled engineers and industrial experience would be able to achieve in the future. One of the key factors was to look at how much material resources were actually needed to build the power plants.

Today, we can see that Asplund’s vision was well founded. The engineering opportunities have been demonstrated at low costs. Now, electricity from solar and wind are the cheapest sources of new electricity in almost the whole world. In Europe, in particular, during 2016 and 2017 costs fell dramatically for offshore wind. In the middle of summer 2016, Danish Dong (now Ørsted) made headlines with a “record low” offer to build offshore wind power near the Dutch coast at a price of €72.7/MWh. A couple of months later Vattenfall won a bid at €60/MWh by the Danish coast, and another two months later in November won the bidding at Kriegers Flak in the Baltic with a price below €50/MWh.

Just a few months later the first subsidy-free offshore wind power was offered to Germany by Dong and Energie Baden-

Württemberg. Soon more subsidy-free offshore wind power was offered by others.

Unsubsidised wind electricity projects, both onshore and offshore, are under construction in northern Europe. While Asplund’s vision included solar power, mainly in the Mediterranean area, costs have fallen so far that solar power is installed without subsidies in Germany and even in Britain.

There are many industrial developments that have resulted in the falling cost of solar and wind. In the solar field, the most important developments have been achieved in the production of solar cells and panels, where material intensities have kept dropping, while automation of manufacturing and economies of scale in manufacturing have contributed further. Installation speed has increased due to more specialised equipment.

In wind power, the size and height of turbines have increased, resulting in more electricity produced per site and foundation, and an increasing number of full-load hours from the generators. The size of onshore wind farms is limited by the transport capacity of roads and the erection capacity of cranes, and is now typically between 2 and 5 MW. At sea there are no such limitations and the plants are continuing to grow, and 12 MW turbines are now undergoing full-scale testing.



But this is not all. The fact that offshore wind farms are growing in size and numbers has resulted in better utilisation of the special ships and equipment used, while more rational utilisation of operation and maintenance staff is also envisioned for the future.

The Arcona wind farm on the German Baltic coast, which opened in April 2019, has a capacity of 0.4 GW. The Hornsea 2 project, in the British North Sea is envisioned to have an installed capacity of 1.4 GW and will deliver more electricity than many of the world's nuclear reactors.

Further growth will yield further industrial experience and lowered costs, making continued development even easier.

**We still have** not reached 700 GW of solar and 300 GW of wind power in Europe, but we are no longer far away. Total installed wind capacity in Europe at the end of 2018 is close to 200 GW and solar capacity is close to 100 GW.

Unlike Gunnar Asplund's vision, the distribution of renewable energy plants has not yet exploited the largest resource potential. Most of the wind farms are on-shore, while Asplund envisioned utilisation of the vast offshore potential of the Baltic and North Sea. Most solar capacity is in Germany, while Asplund saw the main resources as northern Africa and the very south of Europe.

This discrepancy has several explanations. The first is that, until the last couple of years, development has been dependent on subsidies that have been offered by just a few countries, with Germany as the champion. Secondly, Asplund saw the value of a high-capacity, high-voltage transmission system in Europe. This has also been recognised by the European institutions. But despite high ambitions, the growth in transmission capacity within the European Union, and even within some countries, has been too slow to allow utilisation of the full, low-cost renewable potential. The challenges in obtaining permission to build new lines have proven to be way more difficult than the technology itself.

Most offshore wind potential is still there, waiting to be utilised. In the Baltic Sea, a project operating under the Baltic Sea Region Energy Cooperation, BAS-REC, identified a technical and economic potential of 300 GW in the Baltic alone,

though they concluded that competing interests could block most of this potential, leaving only 35 GW as their target potential.

In the North Sea the potential is greater. Several hundred GW appears to be available. At the Clean Energy Ministerial in Copenhagen in 2018, The North Sea Power Hub Consortium presented a vision for 70–150 GW by 2040, . The idea is to build a grid and subsea cables between the North Sea countries, and to establish a hub on an artificial island in the North Sea.

It appears feasible to provide significantly more solar and wind electricity in Europe than in Asplund's vision in the 1990s. It also appears to be do-able at much lower costs than implicitly assumed in his vision, which included large-scale hydrogen storage and an extensive power grid.

The scope today is more ambitious. It is not just a matter of making electricity 100% renewable. It is also about using low cost electricity to substitute fossil fuels in other sectors, and to produce gaseous and liquid fuels from electricity. This will require more electricity than current use, but on the whole the primary energy figures may decrease as solar and wind electricity substitute electricity based on inefficient conversion of fossil fuels.

Most important is that an electricity system used for producing fuels can use the fuel production as a means to balance power production of solar and wind with primmer electricity demand. Producing fuels will be the most important storage system.

Development is still slow as few have understood the economic opportunities after costs have dropped.

Establishing power grids at sea between many independent countries will require international cooperation, which should be possible within the European Union.

The opportunities to substitute all fossil fuels and emission with low-cost renewable electricity for the first time shows that climate protecting measures may improve industrial competitiveness and prosperity.

Tomas Kåberger

Tomas Kåberger is an energy policy scientist who has worked as Director for the Energy Agency in Sweden, is chairing the Renewable Energy Institute in Japan and is a professor at Chalmers Technical University.

## A 4°C temperature rise

An average heating of the entire globe by 4°C would render the planet unrecognisable from anything humans have ever experienced. The last time the world was this hot was 15 million years ago during the miocene, when intense volcanic eruptions in western North America emitted vast quantities of CO<sub>2</sub>. Sea levels rose some 40 metres higher than today and lush forests grew in Antarctica and the Arctic. A 4°C rise in global average temperatures would force humans away from equatorial regions. This is how the future would look according to an article in the Guardian which summarises scientific findings.

The Guardian 18 May 2019

<https://www.theguardian.com/environment/2019/may/18/climate-crisis-heat-is-on-global-heating-four-degrees-2100-change-way-we-live>

## Doha Amendment must be ratified

The United Nations is encouraging governments to ratify as soon as they can the amendments relating to the second commitment period of the Kyoto Protocol, the international emissions reduction treaty. Ratification of the Doha Amendment to the Kyoto Protocol is a valuable part of the momentum for global climate action for the years leading up to 2020. As of 8 May 2019, 128 Parties have deposited their instrument of acceptance, 16 more countries have still to sign for the amendment to be ratified.

<https://unfccc.int/process/the-kyoto-protocol/the-doha-amendment>

[https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtsg\\_no=XXVII-7-c&chapter=27&clang=en](https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtsg_no=XXVII-7-c&chapter=27&clang=en)

[https://unfccc.int/files/kyoto\\_protocol/application/pdf/kp\\_doha\\_amendment\\_english.pdf](https://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf)



Sixteen more signatures needed.

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# Science confirms that students are right – we can act now

State-of-the-art Climate Model “One Earth<sup>1</sup>” backed by the Leonardo DiCaprio Foundation maps out a feasible pathway to keeping global warming below 1.5°C – joining the dots between energy strategies and nature conservation measures for the first time.

The new climate movement kicked off by Greta Thunberg is getting more and more traction. And with this success, critique is growing and climate sceptics are starting to push back. But those people are running out of factual arguments and using bullying tactics instead. In its 2 May 2019 edition The Guardian documented the disgraceful bullying by two right-wing web editors. Aditya Chakraborty writes that “The hounding of Greta Thunberg is proof that the right has run out of ideas”<sup>2</sup>.

Fortunately, the youth climate movement is not alone and scientists around the world support their case. Climate change is not a possible future scenario. Its happening, and we can do something about it.

Climate and energy scientists have

created many models to stay within the 1.5°C limit advised by the IPCC, but nearly all have relied upon Bio-Energy with Carbon Capture and Storage (BECCS) – which is not proven at scale and displaces agricultural land – while some advocate for bizarre geoengineering solutions like Solar Radiation Management (SRM), which involves spraying chemicals in the air to block sunlight.

Indeed, this year has seen a flurry of stark climate warnings, with the Intergovernmental Panel on Climate Change describing the havoc that 1°C of global warming is already wreaking. After decades of fossil fuel consumption, the degradation of forests and natural ecosystems, and the release of other greenhouse gases, we are seeing the real-world manifestations

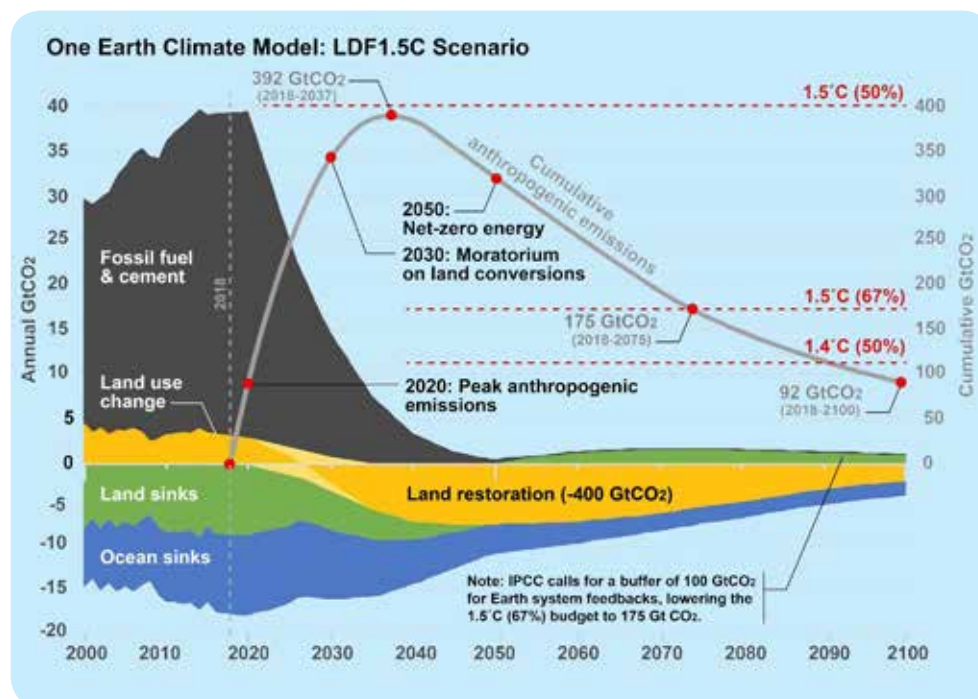
of a more volatile climate: increasingly common floods, droughts, hurricanes and wildfires; poor air quality as a public health emergency; rampant deforestation leading to habitat loss and increased carbon emissions.

So, for the past two years, with support from the Leonardo DiCaprio Foundation, I have led a research program at the University of Technology Sydney, in collaboration with the German Aerospace Center and the University of Melbourne, to find a solution to achieving the 1.5°C limit without geoengineering. The outcome, a high-ambition climate plan which, for the first time, brings together energy strategies and nature conservation measures, was showcased in Davos this week.

Using a cutting-edge energy modelling tool and greenhouse gas model, we show the possibility of meeting 1.5°C through a switch to 100% renewable energy by 2050 and an expansion in energy storage and efficiency measures, together with natural climate solutions (NCS) like reforestation and agricultural practices to reduce emissions. This research lays the scientific foundations for a ground-breaking new climate initiative from LDF, published in early 2019.

At its heart is the large-scale electrification of heating and transport. Almost 90 percent of all transport energy comes from oil used in inefficient combustion engines, which will be replaced by efficient electric drives powered by renewable electricity. Heavy-duty trucks, freight trains, shipping and aviation will use synthetic fuels – produced by renewable energies – and limited biofuels, with oil being phased out by 2050.

The increase in electricity supply will be met mainly through solar



The One Earth climate model (LDF 1.5 scenario) documented in Achieving the Paris Climate Agreement Goals (Teske, ed. 2019), shows the possibility of staying below the 1.5°C climate threshold. The IPCC special report Global Warming of 1.5°C (SR1.5) calls for a carbon budget of 400 GtCO<sub>2</sub> to maintain a chance of staying below the threshold of 1.5°C in global average temperature rise, adjusted to account for additional warming since the beginning of the industrial era (circa 1750). The budget for a good chance (>67%) of 1.5°C is 175 GtCO<sub>2</sub>, accounting for a buffer of 100 GtCO<sub>2</sub> for biosphere feedbacks in the second half of the century, such as melting permafrost, which is achieved by 2075. This is the first climate model to offer a chance of lowering global temperatures to 1.4°C by the end of the century without geoengineering.





The increase in electricity supply will be met mainly through solar and wind.

and wind, which are already becoming more viable than coal and gas. The solar market grew 29.3 percent in 2017, bringing total operating capacity to 405 GW – 89 percent of which was installed in the last seven years. Offshore wind costs are falling, and turbines are getting bigger; it will not be long until one wind farm can power a whole city. Our projection that renewables can provide around 70 percent of electricity demand in 2030 and 100 percent by 2050 looks ever more achievable.

**Crucially, it is possible to switch to 100 percent renewables by recycling parts of the gas infrastructure. After 2030, the gas industry can be converted into hydrogen using much of the same equipment and pipelines – with some technical adjustments – and employing many of the same workers.**

Added to the renewables surge will be a major expansion in storage – pumped hydroelectric and batteries – and a global efficiency program centred on insulation, efficient lighting and strict efficiency standards for all appliances.

Finally, natural climate solutions must play a pivotal role. On its own, the emissions reduction brought about by renewables will not be enough. But if natural carbon sinks – forests, mangroves, and grasslands – can be kept intact, they will absorb about half of the emissions we need. And through a

moratorium on deforestation, restoration of degraded forests, grasslands, and wetlands, and better agriculture practices, we can ensure enough emissions are absorbed to reach the 1.5°C goal.

What we need now are policy signals showing serious commitment to a greener future. Energy companies and investors need stable policymaking on renewables to feel confident that their investments will pay off. A number of countries have already pledged to phase out coal by 2030 and committed to ambitious renewables targets. But many key political leaders are dragging their feet, either because of a failure to see beyond traditional infrastructure, to grasp the dangers posed by climate change, or to understand the economic potential of the zero-carbon economy – or all of the above.

With some countries blocking the IPCC report and shamelessly promoting fossil fuels, it is crucial that decision makers can see there is a desirable pathway to a cleaner jobs-generating economy, a better quality of life for citizens, and proper protection for our natural world.

Meanwhile, the students are getting prominent support from Sir David Attenborough. For his audience at the World Economic Forum at the end of January 2019 in Davos, Switzerland, his message could not have been clearer: our natural world is in a desperate state of crisis – and we urgently need a global plan to fix it.

The Global Plan is there: The One Earth climate model is ground-breaking in that it shows the 1.5°C target can be achieved through a rapid transition to 100 percent renewables by 2050 (65% by 2030), alongside a major conservation effort to increase the resilience of natural ecosystems and help ensure greater food security. This includes a moratorium on land conversions by 2030 and 400 GtCO<sub>2</sub> of ‘negative emissions’ from forest and land restoration (shown in gold below the zero line), which pulls carbon dioxide out of the atmosphere and stores it in trees and soil.

The One Earth Climate Model<sup>3</sup> provides a detailed global plan and all the results can be accessed for free on a dedicated website and an open-access book<sup>4</sup>. We have all the knowledge and the technology we need to make this shift, right now. However, we might not have the required politicians needed to implement this plan. But change is possible. It is not too late. Yet.

Dr Sven Teske

University of Technology Sydney, Institute for Sustainable Futures /Australia

<sup>1</sup> <https://www.springer.com/gp/book/9783030058425#aboutBook>

<sup>2</sup> <https://www.theguardian.com/commentis-free/2019/may/01/greta-thunberg-right-environmental-activist-attacks>

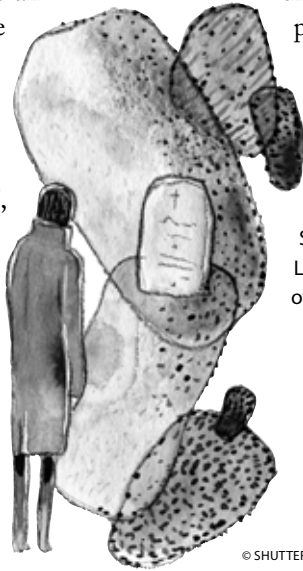
<sup>3</sup> <https://oneearth.uts.edu.au/>

<sup>4</sup> <https://www.springer.com/gp/book/9783030058425#aboutBook>



# Toxic air will shorten children's lives by 20 months

The life expectancy of children born today will be shortened by 20 months on average by breathing the toxic air that is widespread across the globe, with the greatest toll in south Asia, according to a new study. Air pollution contributed to nearly one in every ten deaths in 2017, making it a bigger killer than malaria and road accidents and comparable to smoking, according to the State of Global Air (SOGA) 2019 study.



"That the life of children is being shortened so much came as really quite a shock," said Robert O'Keefe, vice-president of the Health Effects Institute, which produced the report. "There is no magic bullet, but governments should be taking action."

Source: The Guardian, 3 April 2019.  
Link to the report: <http://www.state-of-global-air.org>

Air pollution contributes to almost 10 per cent of deaths globally.

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## Air pollution may cause erectile dysfunction

Air pollution may be damaging men's ability to perform in the bedroom, scientists warn. New research published in the Journal of Sexual Medicine, suggests regular exposure to toxic car fumes is linked with higher rates of erectile dysfunction. Scientists believe inhaling poisonous particles may be triggering inflammation in blood vessels and starving the genitals of oxygen – affecting men's ability to become sexually aroused. It follows animal tests that showed regularly breathing in exhaust fumes damages sex drive.

Source: Daily Mail, 20 March 2019.

# World air quality status – city ranking

New air pollution data compiled in the IQAir AirVisual 2018 World Air Quality Report and interactive World's most polluted cities ranking, prepared in collaboration with Greenpeace Southeast Asia, reveals the state of particulate matter (PM<sub>2.5</sub>) pollution in 2018. It highlights a widespread but unequal distribution of PM<sub>2.5</sub> pollution and limited access to public information.

Frank Hammes, IQAir CEO, said: "The 2018 World Air Quality Report is based on the review, compilation and validation of data from tens of thousands of air quality

monitoring stations around the world. Now everyone with a cellphone has free access to this data via the AirVisual platform. Communities and organizations from California to Kabul are supplementing governmental monitoring efforts with their own low-cost air quality monitoring networks, and are giving everyone access to more hyper-local information."

Findings from the report include that out of the twenty most polluted cities in the world, 18 are in India, Pakistan and Bangladesh. Moreover, ten cities in the Western Balkans (Bosnia Herzegovina,

Macedonia and Kosovo) and four in Turkey have PM<sub>2.5</sub> levels more than three times the WHO guidelines. Eight cities in the Balkans are among the world's most polluted 10 per cent, out of all the cities with data.

Source: Greenpeace press release, 5 March 2019.  
Link to media briefing: <https://www.greenpeace.org/archive-seasia/PageFiles/985332/Most-up-to-date-data-presents-the-world-air-quality-status-Greenpeace-Media-Briefing.pdf>

Sarajevo is one of the cities on the Western Balkan with really bad air quality.





# Global coal power emissions mapped

Closing down the 10 per cent most polluting coal-fired plants would reduce air pollution health impacts from coal power generation by nearly two-thirds.

**Coal-fired power plants** are a major source of both greenhouse gases and toxic air pollutant emissions worldwide. To estimate where action is most urgently required, a Swiss research group at ETH Zurich's Institute of Environmental Engineering has collected new emissions data and modelled and calculated the undesired side effects of emissions for each of the 7,861 power plant units in the world, including emissions from the supply chain, i.e. mining and transport.

The emissions inventory covers carbon dioxide, methane, particulate matter, sulphur dioxide, nitrogen oxides and mercury. Their health and climate change impacts are quantified, and the technical abatement potential is analysed. The results, which were recently published in the journal *Nature Sustainability*, show that total greenhouse gas and toxic substance emissions are largest from coal power in China, the United States, India, Germany and Russia.

China, India and the US are the world's three largest coal consuming and producing countries, and when looking specifically at health impacts, coal power plants in India take the highest toll.

According to the study, Western Europe, North America and China all have more modern power plants, while Eastern Europe, Russia and India still have many older and less efficient power plants with insufficient flue gas treatment, which also often burn coal of inferior quality.

"More than half of the health effects can be traced back to just one tenth of the power plants. These power plants should be upgraded or shut down as quickly as possible," said Christopher Oberschelp, the lead author of the study. A phasing-out of the ten per cent most polluting plants (by capacity) would reduce coal power greenhouse gas emissions by 16 per cent and human health impacts by 64 per cent.



Coal-fired power plant in Dandong, China.

FLICKR.COM / MAX-LEONARD VON SCHAPER CC BY-NC

The global picture of coal power production shows that the gap between privileged and disadvantaged regions is widening. The scientists say that this is happening for two reasons.

Firstly, wealthy countries – such as in Europe – import high-quality coal with a high calorific value and lower emissions of harmful air pollutants. The poorer coal-exporting countries (such as Indonesia, Colombia and South Africa) are left with low-quality coal, which they often burn in outdated power plants without modern flue gas treatment.

Secondly, "In Europe, we contribute to global warming with our own power plants, which has a global impact. However, the local health damage caused by particulate matter, sulphur dioxide and nitrogen oxides occurs mainly in Asia, where coal power is used to manufacture a large proportion of our consumer products," said Oberschelp.

Global coal resources will last for several hundred years, so the harmful emissions

need to be limited politically. Reducing the negative health and environmental effects of coal power generation should be a global priority, but further industrialisation, especially in China and India, poses the risk of aggravating the situation instead, write the researchers.

The initial investment costs for the construction of a coal power plant are high, but the subsequent operating costs are still relatively low. Power plant operators thus have an economic interest in keeping their plants running for a long time. The best option is therefore not to build any new coal power plants. From a health and environment perspective, we must move away from coal and towards clean renewable energy sources.

Christer Ågren

The study: "Global emission hotspots of coal power generation", by C. Oberschelp, S. Pfister, C.E. Raptis and S. Hellweg. Published in *Nature Sustainability*, 2019, doi: 10.1038/s41893-019-0221-6.

Source: ETH Zürich news, 18 February 2019.

# Flemish Green Deal on domestic wood heating

An accelerated replacement or phasing out of old wood-fired heating devices can bring significant additional reductions in PM<sub>2.5</sub> emissions.

**Domestic wood heating** with polluting devices such as older wood stoves and open fireplaces, and the poor use of the domestic wood heating devices, have a significant impact on the environment and health in Flanders, in particular during the heating season.

In 2017 the Flemish Minister for the Environment commissioned the Flemish Environment Department to start preparing a Green Deal on domestic wood heating, together with the relevant sector federation and other government institutions. A Green Deal is an effective and well-suited instrument – due to its systematic approach, structured action plan and broad cooperation between government institutions, civil society organisations, companies and other involved actors – to fully address the many problems that are caused by domestic wood heating.

The Green Deal on domestic wood heating was signed on 22 October 2018 by 24 participating parties, including the initiators. It will run for a period of four years and can possibly be extended. The participants commit themselves to implementing concrete actions: to be clear the Green Deal is an effort commitment and not an obligation of the participants to achieve specific results and objectives.

The key objectives of the Green Deal on domestic wood heating are:

- to reduce emissions of air pollutants, such as PM and PAH, from domestic wood heating by at least 50 per cent by 2030 compared to current levels;
- to phase out at least half of the

old and most polluting stock by 2030, while aiming for a 100% phase out;

- to implement a system to collect all phased-out (removed) wood heating devices in order to prevent resale of these devices in the second-hand market;
- to implement necessary additional regulations and instruments with respect to proper installation, maintenance, inspection and use of wood heating devices.

The Green Deal lists 27 actions, clustered into four groups (see Table):

1. actions to reduce emissions and negative impacts of domestic wood heating in the short term;
2. actions to increase knowledge on emissions and impacts of domestic wood heating;
3. additional supporting actions, i.e. to improve communication, education

and awareness concerning the use of wood heating devices;

4. actions to develop a long-term vision regarding the future role of firewood in domestic heating and regarding the optimised use of wood in a broader context (according to the cascading principle).

Three action-oriented working groups and a steering committee are responsible for the realisation of the concrete actions. The steering committee ensures the overarching management, follow-up and monitoring of the implementation of the Green Deal and is responsible, among other things, for actions relating to the development of an overarching long-term vision.

The core focus of the Green Deal is on the phasing out of old stoves and fireplaces. On the basis of current policies and an

autonomous annual replacement rate of around 1.5–2.5 per cent of the old heating devices, the PM<sub>2.5</sub> emissions from domestic wood heating could be decreased by approximately 25–35 per cent by 2030. An accelerated replacement or phasing out of the old devices could lead to a significant additional reduction of PM<sub>2.5</sub> emissions.

Peter Meulepas

Policy adviser  
Environmental Department –  
Flanders

The report “Green Deal: Huishoudelijke houtherverwarming” is available (in Flemish only) at:

<https://www.lne.be/green-deal-huishoudelijke-houtherverwarming>

The core focus is on the phasing out of old stoves and fireplaces.





Table: Overview of planned actions

N°	Description	Deliverable
<b>Actions to reduce emissions and negative impacts of domestic wood heating in the short term</b>		
1	Exploring the feasibility and potential of phasing out old polluting heating devices (stoves/fireplaces) based on emission limit values, age or other systems (e.g. subsidies)	Identification of most appropriate phase-out system
2	Exploring the feasibility and potential of retrofitting old polluting heating devices	Cost-benefit analysis of retrofitting versus phase-out. Identification of circumstances when retrofitting can be recommended as a solution.
3	Elaborating the most suitable system for phasing out and/or retrofitting old polluting heating devices in Flanders	Legislative or non-legislative proposal to implement the selected system
4	Exploring the possibilities to prevent the resale of phased-out heating devices in the second-hand market	Pilot project with a fully developed system to collect, remove (and dismantle) phased-out devices
5	Setting up supportive communication campaigns around phasing out and retrofitting of old heating devices	Appropriate communication products addressing local authorities, architects, consumers, etc.
6	Discouraging the sale of new wood heating devices that do not meet sufficiently ambitious emission and efficiency requirements	Appropriate communication products to incentivise consumers and dealers towards the best available technologies when purchasing a new device
7	Exploring the potential of technological improvements	Report identifying Best Available Technologies for domestic wood heating systems
8	Promoting further technological research and development	Identification of ways to support further research and development towards near-zero emission wood heating devices
9	Defining conditions and developing instruments concerning the proper installation, maintenance and inspection of wood heating devices and flue gas discharge	Appropriate communication products, supporting tools, regulations defining minimum requirements, code of good practice, etc.
10	Developing rules concerning the proper location of ventilation orifices and chimneys, in particular for energy efficient and air-tight new buildings	Integrated code of good practice
11	Review and revision of current burn wise educational material	Code of good practice on burn wise; communication products and awareness campaigns
12	Facilitating the use of wood moisture meters to encourage the use of dry firewood	Actions supporting the distribution of wood moisture meters and awareness
13	Improving the tackling of nuisance complaints from domestic wood heating	Roadmap/guidance to treat complaints in a structured way
14	Improving market surveillance and enforcement of existing and new regulations on domestic wood heating	Additional market surveillance and enforcement provisions
<b>Actions to increase knowledge on emissions and impacts from domestic wood heating</b>		
15	Knowledge-building on real-world emissions and efficiencies of old and new heating devices	Use of improved knowledge to improve emission inventories, policies and measures, and communication
16	Knowledge-building on the composition of installed heating stock	Methodology to monitor the evolution of the composition of the installed heating stock
17	Knowledge-building on the use of firewood for domestic heating	Methodology to monitor the use of firewood (logs, pellets, chips) per type of heating device
18	Improving estimates of emission projections for domestic wood heating	More reliable projections to be used as a basis for emission reduction policies
19	Improving mapping of local contributions from domestic wood heating	Improved modelling and visualisation of local contributions to air quality
20	Knowledge-building on the exposure from and effects of domestic wood heating	Human biomonitoring research, linking increased exposure to air pollution to firing of wood in domestic heating devices
21	Analysis of the impact from domestic wood heating on indoor air	Health impacts of indoor air pollution from own heating device
22	Analysis of the environmental costs of the different domestic heating systems (wood, coal, gas, solar, heat pumps, etc.)	Report on the analysis
<b>Additional supporting actions</b>		
23	Developing a global communication strategy and coordinating various communication products	Overarching strategy and framework to ensure objective and uniform communication
24	Developing a system for the registration of existing and new heating devices	Registration system
25	Assessment of the applicable legislation at regional, national and European level	Identification of gaps, overlaps and potential improvements, tightening and additions
<b>Actions on developing a long-term vision</b>		
26	Developing a long-term strategy (2030–2050) on domestic heating i.e. taking into account energy and climate change policy, impacts of different heating systems and availability of wood for use as firewood	Defining the future role of domestic wood heating in domestic heating and appropriate boundaries
27	Improving cascading of various wood streams	System to improve optimal use of available and collected wood streams between different uses (as material, energy source, firewood, etc.)



Italian failures come in many shapes and flavours.

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## Italy goes to EU Court over air pollution

On 7 March, the European Commission decided to refer Italy to the EU Court of Justice for failure to respect limit values for nitrogen dioxide (NO<sub>2</sub>), and for failing to take appropriate measures to keep exceedance periods as short as possible. The Commission is calling on Italy to cut pollution levels in ten agglomerations covering around 7 million people. The limit values for NO<sub>2</sub> set out under Directive 2008/50/EC had to be met in 2010.

This referral follows similar action against France, Germany, and the UK in May 2018, for similar failures to respect limit values for NO<sub>2</sub>. In May 2018, Italy was also referred to the Court of Justice over persistently high levels of particulate matter (PM<sub>10</sub>).

Source: EU press release, 7 March 2019. Link: [http://europa.eu/rapid/press-release\\_IP-19-1475\\_en.htm](http://europa.eu/rapid/press-release_IP-19-1475_en.htm).

As from 8 April, only petrol cars that meet the Euro 4 standard and diesel vehicles that meet the tighter Euro 6/VI standard are exempted from an extra charge.

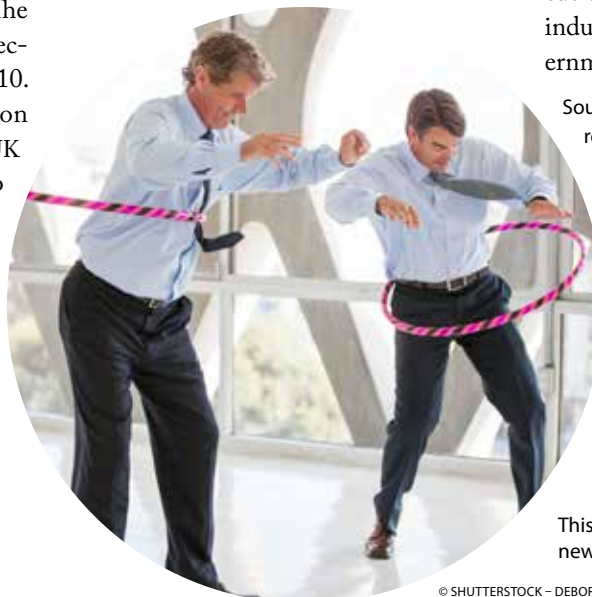
# Most EU governments failed to file air pollution plans on time

National governments were supposed to detail how they plan to reduce emissions of harmful air pollution in “National Air Pollution Control Programmes” (NAPCP), which should have been sent to the European Commission by 1 April. However, one month later, still only 13 of the EU’s 28 member states had filed their plans.

Margherita Tolotto, Clean Air Policy Officer at the EEB said: “It is shocking that more than half of EU governments

have failed to meet a deadline for something this important. Every day of delay in cutting air pollution means more people suffering the consequences for their health.”

The missing air pollution programmes are a requirement of the National Emission Ceilings (NEC) Directive, which sets reduction targets for harmful pollution per country. They should have detailed the measures governments will use to cut emissions from areas like transport, industry and agriculture. Only four governments met the original deadline.



Source: EEB press release, 30 April 2019. Link to reported NAPCPs: [http://cdr.eionet.europa.eu/ReportekEngine/searchdataflow?dataflow\\_uris=http%3A%2F%2Frod.eionet.europa.eu%2Fobligations%2F753&years%3Aint%3Aignore\\_empty=&partofyear=&reportingdate\\_start%3Adate%3Aignore\\_empty=&reportingdate\\_end%3Adate%3Aignore\\_empty=&country=&release\\_status=any&status&sort\\_on](http://cdr.eionet.europa.eu/ReportekEngine/searchdataflow?dataflow_uris=http%3A%2F%2Frod.eionet.europa.eu%2Fobligations%2F753&years%3Aint%3Aignore_empty=&partofyear=&reportingdate_start%3Adate%3Aignore_empty=&reportingdate_end%3Adate%3Aignore_empty=&country=&release_status=any&status&sort_on)

This time our priority was to set a new ministry record for hula hoop.

© SHUTTERSTOCK – DEBORAH KOLB

## London launches ultra-low emissions zone

Green groups have hailed the start of an ultra-low emissions zone (ULEZ) in London that sets the toughest vehicle emission standards for any urban air quality scheme in the world. As from 8 April, only petrol cars that meet the Euro 4 standard and diesel vehicles that meet the tighter Euro 6/VI standard will be exempt from paying a daily charge of £12.50, with lorries, buses and coaches that fail to meet emissions limits paying £100 a day.

The ULEZ was intended to enter force next year but London

mayor Sadiq Khan brought it forward as part of a package of measures to tackle air quality, and plans to expand it substantially in 2021. Data shows the ULEZ improved air quality even before it was introduced, as organisations and businesses began moving to cleaner fleets to avoid the extra cost. Roadside measurements of nitrogen dioxide (NO<sub>2</sub>) within the zone have already dipped by 20 per cent.

The ULEZ, combined with a package of other measures being put in place by the mayor, is expected to deliver compliance with EU NO<sub>2</sub> limits within six years.

Source: Ends Europe Daily, 8 April 2019

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## Exceeding air and noise targets costs EU €25bn

A new report by the European Commission shows the impact of failure on seven policy areas – air and noise, nature and biodiversity, water, waste, chemicals, industrial emissions and major accident hazards, and horizontal instruments – with a total annual cost to the EU's economy amounting to €54.7bn.

Clean air legislation has proven hardest for member states to implement so far, with many countries still struggling with high emission levels. Air pollution and high noise levels were estimated to have cost the EU €24.6bn in 2018, largely due to healthcare costs and days missed in work and education.

Source: Airqualitynews.com, 10 April 2019. Link to the report "The cost of not implementing EU environmental law": [http://ec.europa.eu/environment/eir/pdf/study\\_costs\\_not\\_implementing\\_env Law.pdf](http://ec.europa.eu/environment/eir/pdf/study_costs_not_implementing_env Law.pdf)

# Old boilers – high emissions

Together with researchers and experts in the other Nordic countries, the Swedish Environmental Research Institute IVL has measured and analysed emissions of particles and short-lived climate-impacting air pollutants from the most common types of wood-fired stoves and boilers.

As expected, emissions were higher in older installations than in more modern ones. For example, under normal conditions, emissions from old wood boilers were between five and

Pollutes five to ten times more than the modern version.

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## Denmark scraps old wood stoves

Starting in February, Danes who scrap old (pre-1995) and polluting wood stoves can get a scrap premium of just over DKK 2000. Today, there are some 700,000 domestic stoves and fireplaces in Denmark. Of these, approximately 200,000 date from before 1995.

The funds allocated are enough to scrap just under 20,000 stoves. Based on the experience from a previous scrappage scheme in 2015–2016, the Danish EPA expects that 10 per cent of these will disappear. The rest are expected to be replaced by new, cleaner and more efficient stoves. The scheme expires when the funds are exhausted, but no later than the end of 2020.



Flickr.com / PETER DURAND CC BY-NC-ND

The future of 20,000 Danish stoves.

The scheme will be accompanied by a communication effort to promote faster replacement of old domestic wood-burning installations. Particle pollution from domestic wood-burning causes about 400 premature deaths a year in Denmark.

Source: Danish EPA press release, 5 February 2019 (in Danish). Link: <https://mst.dk/service/nyheder/nyhedsarkiv/2019/feb/fra-i-dag-kan-du-faa-2000-kr-for-din-gamle-braendeovn/>

## Polish top court upholds solid fuel ban for Krakow

The ruling on 12 March by Poland's Supreme Administrative Court follows an anti-smog resolution approved by the country's Regional Administrative Court. The ban will enter into force from 1 September 2019, and the judgment cannot be appealed. It now paves the way for similar local anti-smog resolutions to be passed.

Krakow and the surrounding Malopolska region are among the most polluted regions in the EU, especially for particulate matter (PM<sub>10</sub>), which has exceeded the annual legal limit for years. The main cause is increased dust emissions from burning solid fuels (coal and wood) for heating, in particular for domestic heating.

Source: ClientEarth press release, 12 March 2019. Link: <https://www.clientearth.org/polands-top-court-upholds-solid-fuel-ban-for-krakow/>



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# How air pollution is doing more than killing us

The air we breathe could be changing our behaviour in ways we are only just beginning to understand.

**In the future**, police and crime prevention units may begin to monitor the levels of pollution in their cities, and deploy resources to the areas where pollution is heaviest on a given day.

This may sound like the plot of a science fiction movie, but recent findings suggest that this may well be a worthwhile practice.

Why? Emerging studies show that air pollution is linked to impaired judgement, mental health problems, poorer performance in school and most worryingly perhaps, higher levels of crime.

These findings are all the more alarming, given that more than half of the world's population now live in urban environments – and more of us are travelling in congested areas than ever before. Staggeringly, the World Health Organization says nine out of 10 of us frequently breathe in dangerous levels of polluted air.

Air pollution kills an estimated seven million people per year. But could we soon add murder figures into this too? BBC Future considers the evidence.

It was in 2011 that Sefi Roth, a researcher at the London School of Economics was pondering the many effects of air pollution. He was well aware of the negative outcome on health, increased hospital admissions and also mortality. But maybe, he thought, there could be other adverse impacts on our lives.

To start with, he conducted a study looking at whether air pollution had an effect on cognitive performance.

Roth and his team looked at students taking exams on different days – and also measured how much pollution was in the air on those given days. All other variables remained the same: The exams were taken by students of similar levels of education, in the same place, but over multiple days.

He found that the variation in average results were staggeringly different. The most polluted days correlated with the worst test scores. On days where the air quality

was cleanest, students performed better.

“We could see a clear decline [of performance] on days that were more highly polluted,” says Roth. “Even a few days before and a few days after, we found no effect – it’s really just on the day of the exam that the test score decreased significantly.”

**To determine the** long-term effects, Roth followed up to see what impact this had eight to 10 years later. Those who performed worst on the most polluted days were more likely to end up in a lower-ranked university and were also earning less, because the exam in question was so important for future education. “So even if it’s a short-term effect of air pollution, if it occurs in a critical phase of life it really can have a long-term effect,” he says. In 2016 another study backed up Roth’s initial findings that pollution can result in reduced productivity.

These insights are what led to Roth’s most recent work. In 2018 research his team analysed two years of crime data from over 600 of London’s electoral wards, and found that more petty crimes occurred on the most polluted days, in both rich and poor areas.

It’s important to note that this finding is purely correlational – but Roth has reason to believe that there is a causal link.

His team also compared very specific areas over time, as well as following levels of pollution over time. A cloud of polluted air, after all, can move around depending which direction the wind blows. This takes pollution to different parts of the city, at random, to both richer and poorer areas. “We just followed this cloud on a daily level and see what happened to crime in areas when the cloud arrives... We found that wherever it goes crime rate increases,” he explains.

Importantly, even moderate pollution made a difference. “We find that these large effects on crime are present at

levels which are well below current regulatory standards.” In other words, levels that the US Environmental Protection Agency classifies as “good” were still strongly linked with higher crime rates.

While Roth’s data didn’t find a strong effect on the more serious crimes of murder and rape, another study from 2018 has shown a possible link. The research, led by Jackson Lu of MIT examined nine years of data and covering almost the entire US in over 9,000 cities. It found that “air pollution predicted six major categories of crime”, including manslaughter, rape, robbery, stealing cars theft and assault. The cities highest in pollution also had the highest crime rates. This was another correlational study, but it accounted for factors like population, employment levels, age and gender – and pollution was still the main predictor of increased crime levels.

Further evidence comes from a study of “delinquent behaviour” (including cheating, truancy, stealing, vandalism and substance use) in over 682 adolescents. Diana Younan, of the University of Southern California, and colleagues looked specifically at PM<sub>2.5</sub> – tiny particles 30 times smaller than the width of a human hair – and considered the cumulative effect of exposure to these pollutants over a period of 12 years. Once again, the bad behaviour was significantly more likely in areas with greater pollution.

To check the link couldn’t simply be explained by socioeconomic status alone, Younan’s team also accounted for parental education, poverty, the quality of their neighbourhood, and many other factors, to isolate the effect of the microparticles compared to these other known influences on crime.

Younan says that her findings are especially worrying as we know that how an individual behaves during adolescence is a







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Researchers have found a possible link between crime and air pollution levels.

strong predictor of how they will behave as an adult. Delinquent individuals are more likely to perform worse at school, experience later unemployment and are more prone to substance abuse. This means that an intervention at an early age should be a priority.

There are many potential mechanisms that might explain how air pollution affects our morality.

Lu, for instance, has shown that the mere thought of pollution can influence our psychology through its negative associations.

Naturally, the researchers were unable to physically expose participants with pollution, so they took the next best (ethically approved) step. They showed both US and Indian participants photos of an extremely polluted city, and asked them to imagine themselves living there. “We made them psychologically experience the effects of pollution,” Lu explains. “...then asked them to really imagine living in this city, and how they would feel and how their life would be living in this environment, to make them psychologically experience air pollution versus a clean environment.”

He found that the participant’s anxiety, and they became more self-focussed – two responses that could increase aggressive and irresponsible behaviours. “As a self-protection mechanism we all know that when we are anxious we are more likely to punch someone in the face, than when

we are calm,” says Lu. “So, by elevating peoples’ anxiety, air pollution can have a detrimental effect on behaviour.”

Across further experiments, the team showed that participants in the “polluted” conditions were more likely to cheat on several tasks and overrate their performance in order to get rewards.

This research is just the start, and there could be many reasons for these effects besides the increased anxiety and self-focus that Lu describes – including physiological changes to the brain. When you breathe in polluted air, for example, it affects the amount of oxygen you have in your body at a given moment – and that in turn, can result in reduced “good air” going to your brain. It can also irritate the nose, throat, cause headaches – all of which can lower our concentration levels.

It’s also clear that exposure to various pollutants can cause inflammation in the brain and can damage brain structure and neural connections. “So what could be happening is that these air pollutants are damaging the pre-frontal lobe,” says Younan. This is the very area important for controlling our impulses, our executive function and self-control.

**Besides elevating crime,** that might also bring about a serious decline in mental health. A March 2019 study even showed that teenagers exposed to toxic, polluted air are at a higher risk of psychotic episodes, such as hearing voices or paranoia. Lead researcher Joanne Newbury, from King’s College London, says she cannot yet claim that her results are causal, but the findings are in line with other studies suggesting a link between air pollution and mental health. “It does add to evidence linking air pollution to physical health problems and air pollution link to dementia. If it’s bad for the body, it’s to be expected that it’s bad for the brain,” she says.

Those in the field say that there now needs to be greater awareness of the impact of pollution, along with the well-established effect on our health. “We need more studies showing the same thing in other populations and age groups,” says Younan.

Fortunately, we do have some control over just how much pollution we are exposed to day-to-day. We can be proactive

and look up the air quality around us on a given day. Monitors highlight the days it is most dangerous, and when it is lowest. “If it’s dangerous I wouldn’t suggest going for a run outside, or do your work indoors,” says Younan.

While many countries are waiting for stricter legislation or government intervention to curb pollution, some places have taken positive steps. Take California, where regulation has resulted in less pollution, and interestingly, also less crime. Though promising, Younan stresses that we don’t yet know if this is coincidence or not. Meanwhile in London, from 8 April 2019 there will be a new “ultra low emission zone” which has stricter emission standards with an additional £12.50 (\$16.30) daily charge for “most vehicle types” on top of the existing £11.50 congestion charge. A greater number of greener busses are also being phased in under the “cleaner air for London” initiative.

“We are doing a fairly good job in cutting pollution in many countries, but we should do more,” says Roth. “It’s not necessarily just government. But it’s also you and I. When we think about what we want to buy, how to get to places, we all affect the environment and we need to be more aware of that and make more informed decisions of what we do.”

Roth remains hopeful that rising pollution is something that is in our control to solve, but until we do we need to make people more aware of the issues.

If we all begin to monitor pollution levels ourselves, we then might start making it a habit to avoid certain activities, like outdoor sports, or even commuting on the most polluted days. Our bodies, brains, and behaviours will benefit.

Melissa Hogenboom

Melissa Hogenboom is editor of BBC Reel. Her film on the same topic can be seen here: <https://www.bbc.com/reel/video/p075wk3s/the-hidden-impacts-of-air-pollution>

She is @melissasuzanneh on twitter.

This article was first published by the BBC on 16 April 2019. Link: <http://www.bbc.com/future/story/20190415-how-air-pollution-is-doing-more-than-killing-us>

# Global health impacts of vehicle exhaust

Study links ambient levels of toxic particles and ozone specifically caused by vehicle exhaust emissions to 385,000 premature deaths worldwide in 2015, of which 60,000 were due to emissions from shipping.

**A new study** by the International Council on Clean Transportation (ICCT) provides the most detailed picture available to date of the global, regional, and local health impacts attributable to emissions from four transportation subsectors: on-road diesel vehicles, other on-road vehicles, shipping, and non-road mobile engines such as agricultural and construction equipment.

Health impacts at the global, regional, national, and local levels in 2010 and 2015 were estimated by linking data on vehicle emissions of air pollutants with epidemiological models.

The results show that vehicle tailpipe emissions were linked to 361,000 premature deaths from ambient particulate matter (PM<sub>2.5</sub>) and ground-level ozone worldwide in 2010, and 385,000 in 2015. Together, PM<sub>2.5</sub> and ozone concentrations from transportation emissions resulted in 7.8 million years of life lost and approximately US\$1 trillion in health damages globally in 2015.

Exhaust from on-road diesel vehicles was responsible for nearly half of the impacts (181,000 premature deaths) worldwide, and fully two-thirds in India, France, Germany, and Italy.

“Transportation-attributable health impacts declined in the US, EU, and Japan as vehicle emission standards have been implemented, but these reductions have been offset by growing impacts in China, India, and other parts of the world,” said Susan Anenberg, lead author of the study. “Unless the pace of transportation emission reductions is accelerated, these health impacts are likely to increase in the future as the population grows, ages, and becomes more urbanized.”

“The high public health burden of diesel vehicles in Europe underscores the need for world-class emissions standards

to be accompanied by robust compliance and enforcement,” said co-author Joshua Miller. “The long lifetime of vehicles and equipment and the increasing health burden in regions without adequate protections stress the urgency to introduce world-class standards, develop compliance programs, and adopt in-use measures that accelerate the replacement of high-emitting vehicles.”

**In addition to** estimated health effects on global, regional, and national scales, the study also evaluated the impacts in 100 major urban areas worldwide and found that the urban areas with the highest number of transportation-attributable air pollution deaths per 100,000 people were Milan, Turin, Stuttgart, Kiev, Cologne, Haarlem, Berlin, Rotterdam, London, and Leeds. The number of transportation-attributable deaths per 100,000 population in London and Paris are approximately 2 to 3 times higher than the global average.

A surprisingly large fraction of the early mortality – approximately 15 per cent, or 60,000 deaths – was due to air pollution from the 70,000 international ships that ply the world’s oceans. That equates to about US\$160 billion of health damages annually.

Moreover, the study highlights the uneven distribution of premature mortality due to air pollution from international shipping (see Table). China, which hosts seven of the ten busiest ports by throughput and has many millions living near impacted coastlines, accounts for more than one third (37%) of the estimated 60,000 premature deaths. Likewise, Japan (4,100), India (3,400), the UK (3,200), and Indonesia (1,900) each ranked within the top five by total early deaths due to their large populations and exposure to air pollution from major shipping lanes.

On the other hand, the per-capita early death rate, as expressed in deaths per 100,000 population, shows a very different set of countries. On this metric, Singapore is the country most impacted by air pollution from ships. Moreover, six of the ten most impacted countries are in the EU, namely Denmark, Netherlands, UK, Belgium, Ireland and Portugal. Only Japan and the UK appear in the top ten most impacted countries on both metrics.

The study’s conclusions are conservative. Recent evidence indicates that the health response to PM<sub>2.5</sub> pollution may be greater at high concentrations than previously estimated, and that air pollution may be associated with chronic kidney disease, preterm birth and other birth outcomes, and cognitive decline. Consideration of these impacts would likely increase the estimate of health impacts from vehicle exhaust emissions.

Christer Ågren

Sources: ICCT press release, 26 February 2019, and ICCT staff blog post, 22 March 2019, link: <https://www.theicct.org/blog/staff/silent-deadly-case-shipping-emissions>

The report “A global snapshot of the air pollution-related health impacts of transportation sector emissions in 2010 and 2015”. By S. Anenberg et. al. Published by the ICCT. Link: [www.theicct.org/publications/health-impacts-transport-emissions-2010-2015](http://www.theicct.org/publications/health-impacts-transport-emissions-2010-2015)



PM<sub>2.5</sub> and ozone concentrations from transportation emissions resulted in 7.8 million years of life lost in 2015.



# Iceland's first electrified ferry

ABB supplies the drive system and energy storage technology for Iceland's first electrified ferry. The 70-metre vessel will be equipped with a 3,000 kWh battery pack and run in fully electric mode most of the time. This means that the onboard diesel generator only serves as a backup for the electric ferry in particularly difficult weather conditions. The boat will make 3,600 annual trips in the rough waters between Landeyjahöfn on the mainland

and the Westman Islands, covering 13 km in about 45 minutes. On average, it will take about 30 minutes to recharge the battery system. The ferry will have a capacity of 550 passengers and 75 cars, and delivery is set before the year's end.

Source: electrive.com, 14 February 2019.

## Baltic Sea SECA has saved thousands of lives

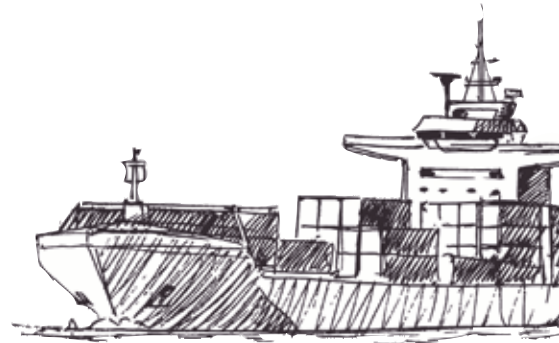
Thousands of lives in North Europe have been saved as a result of the Sulphur Emission Control Area (SECA), whereby ships' fuel has been limited to max 0.1 per cent sulphur in the Baltic Sea. The research project EnviSuM has estimated that the requirements for Baltic sailings have prevented between 500 and 1000 premature deaths annually in the region.

Source: ShippingWatch, 25 April 2019. Link to EnviSuM website: <https://blogit.utu.fi/envisum/>

## 110 shipping companies support speed limit

In an open letter to the UN's International Maritime Organization (IMO), the 110 companies express their support for proposals from several countries to implement regulations on vessel speed, which will reduce ships' greenhouse gas emissions. Several environmental NGOs, including Clean Shipping Coalition, T&E, WWF, Greenpeace and AirClim, are also signatories of the letter.

Source: "Open letter to IMO Member States supporting mandatory speed measure to reduce shipping emissions", 30 April 2019. Link: [https://www.transportenvironment.org/sites/te/files/publications/Joint%20industry\\_NGO%20speed%20letter%20to%20the%20IMO.pdf](https://www.transportenvironment.org/sites/te/files/publications/Joint%20industry_NGO%20speed%20letter%20to%20the%20IMO.pdf)

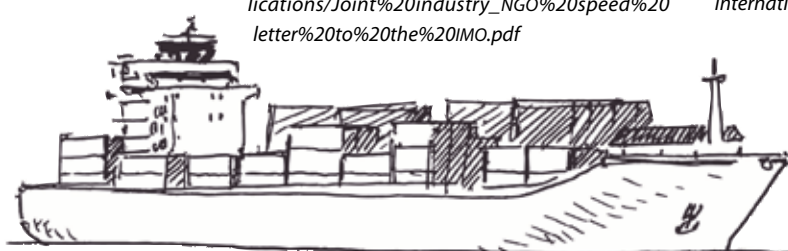


## EC study backs speed limits for ships

A study funded by the European Commission (EC) and led by CE Delft has come out in favour of implementing speed limits for ships, saying it is one of only a few ways the shipping industry can meet its pledge to cut greenhouse gas emissions.

Capping the average speed at 20 per cent below 2012 levels could reduce annual CO<sub>2</sub> emissions in 2030 by 24 to 34 per cent, compared to business-as-usual, according to the study.

Source: Ship&Bunker, 3 May 2019. Link to the study "Study on methods and considerations for the determination of greenhouse gas emission reduction targets for international shipping": <https://www.cedelft.eu/en/publications/2297/study-on-methods-and-considerations-for-the-determination-of-greenhouse-gas-emission-reduction-targets-for-international-shipping?>



# Support for a Mediterranean Emission Control Area growing

Italy has declared its support for controlling ship emissions in the Mediterranean, the country's Minister of Environment Sergio Costa declared at a recent G7 summit held in Metz, France. At the summit, France and Italy agreed to push for a full Emission Control Area (ECA) covering the entire Mediterranean Sea,

to limit ships' emissions of both sulphur and nitrogen oxides (see AN 1/19, pp. 4–7). Previously, Barcelona's municipal council had pledged support for the Mediterranean ECA and was joined by Spain in March.

"This is good news for all people in the Mediterranean as it contains a timeframe and a meaningful event – the Naples Conference in December under the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean – within

which all countries in the Mediterranean basin will be able to show support for the protection of health of their citizens and the Mediterranean marine environment. The citizens of Italian port cities have contributed to this result highlighting for years the unsustainable impact of shipping emissions in their home towns," said Anna Gerometta from Italian environmental group Cittadini per l'Aria.

Sources: NABU press release 6 May; Safety4sea 20 March; ShippingWatch 7 May.

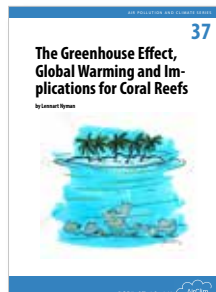


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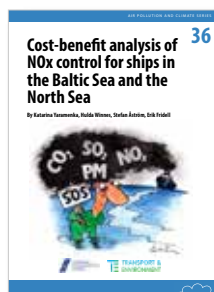
Air Pollution & Climate Secretariat  
Första Långgatan 18  
413 28 Göteborg  
Sweden

## Recent publications from the Secretariat

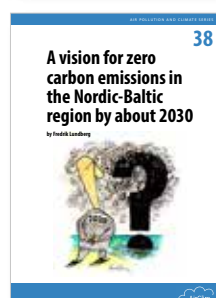
Reports can be downloaded in PDF format from [www.airclim.org](http://www.airclim.org)



**The Greenhouse Effect, Global warming and Implications for Coral Reefs** (March 2018). By Lennart Nyman. Tropical coral reefs harbour 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, Hilda Winnes, Stefan Åström, Erik Fridell.



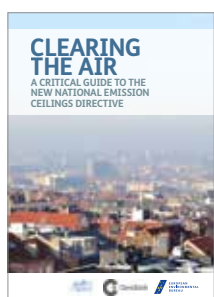
**A vision for zero emissions in the Nordic-Baltic region by about 2030** (March 2018). By Fredrik Lundberg. A scenario for the electricity, heat and industrial sectors.



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



**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 CO<sub>2</sub> the ocean is becoming more acidic, and this happens at a rate faster than any period in the past 300 million years.



**Phasing out coal in Europe by 2025** (Feb 2019). By Fredrik Lundberg. An updated list of coal power stations throughout Europe and a proposal of phasing out coal by 2025.

## Coming events

**UNFCCC SB50.** Bonn, Germany, 17 - 27 June 2019. Information: <http://unfccc.int/>

**EU Environment Council.** Luxembourg, 26 June 2019. Information: [www.consilium.europa.eu/en/press/calendar/](http://www.consilium.europa.eu/en/press/calendar/)

**Air Pollution 2019: 27th International conference on modelling, monitoring and management of air pollution.** Aveiro, Portugal, 26 - 28 June 2019. Information: <https://www.wessex.ac.uk/conferences/2019/air-pollution-2019>

**Informal EU Environment Council.** Finland, 11 - 12 July 2019. Information: [www.consilium.europa.eu/en/press/calendar/](http://www.consilium.europa.eu/en/press/calendar/)

**SIF Air - Bringing forward solutions for improved air quality.** Göteborg, Sweden, 28 August 2019. Information: <https://www.unsdsn-ne.org/our-actions/solutions-initiative-forums/air/>

**Shipping & the Environment II - From regional to global perspectives.** Göteborg, Sweden, 4 - 6 September 2019. Information: <http://s-and-e-2019.ivl.se>

**CLRTAP EMEP Steering Body and the Working Group on Effects.** Geneva, Switzerland, 9 - 13 September 2019. Information: [www.unece.org/env/lrtap/welcome.html](http://www.unece.org/env/lrtap/welcome.html)

**UN Climate Summit 2019.** New York, USA, 23 September 2019. Information: <http://www.un.org/en/climatechange/>

**18th IUAPPA World Clean Air Congress.** Istanbul, Turkey, 23 - 27 September 2019. Information: [www.wcac2019.org](http://www.wcac2019.org)

**Integrated Nitrogen Management Workshop.** Brussels, Belgium, 30 September - 2 October 2019. Information: [https://ec.europa.eu/info/events/workshop-integrated-sustainable-nitrogen-management-2019-sep-30\\_en](https://ec.europa.eu/info/events/workshop-integrated-sustainable-nitrogen-management-2019-sep-30_en)

**EU Environment Council.** 9 October 2019. Information: [www.consilium.europa.eu/en/press/calendar/](http://www.consilium.europa.eu/en/press/calendar/)

**IMO Intersessional Working Group on reduction of GHG emissions from ships.** London, UK, 11 - 15 November 2019. Information: [www.imo.org](http://www.imo.org)

**EU Clean Air Forum.** Bratislava, Slovakia, 28 - 29 November 2019. Information: [https://ec.europa.eu/info/events/eu-clean-air-forum-2019-nov-28\\_en](https://ec.europa.eu/info/events/eu-clean-air-forum-2019-nov-28_en)

**UNFCCC COP25.** Chile, 11 - 22 November 2019. Information: <http://unfccc.int/>

**CLRTAP Executive Body.** Geneva, Switzerland, 9 - 13 December 2019. Information: [www.unece.org/env/lrtap/welcome.html](http://www.unece.org/env/lrtap/welcome.html)

**EU Environment Council.** 19 December 2019. Information: [www.consilium.europa.eu/en/press/calendar/](http://www.consilium.europa.eu/en/press/calendar/)

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