NO. 1, APRIL 2015

Acid News

Industrial air pollution cost €189 billion/year

The cost of damage caused by pollutant emissions into the air from the largest 14,000 industrial facilities in 2012 has been estimated as at least €59-189 billion.

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Norwegian CCS ambitions might move to the EU

Norway wants an agreement with the EU on collective delivery of a common climate target. This could make it easier to finance a full-scale CCS plant in one of the EU member states.

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Enforcement of ship sulphur standards

Member states must carry out inspections on at least one-tenth of the ships calling each year, and test the fuel on at least 20–40 per cent of the inspected ships.

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Launch of Energy Union – mixed messages

The Commission proposes a range of policy and legislative packages to realise the Energy Union in the next five years.

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East German lignite at a crossroads

Lignite power in eastern Germany is disastrous for the climate and displaces more people than any other industry in Europe.

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Achieving NEC targets will cost less

Achieving the Commission's health protection target for 2030 will be a third cheaper than previously estimated, according to new data.

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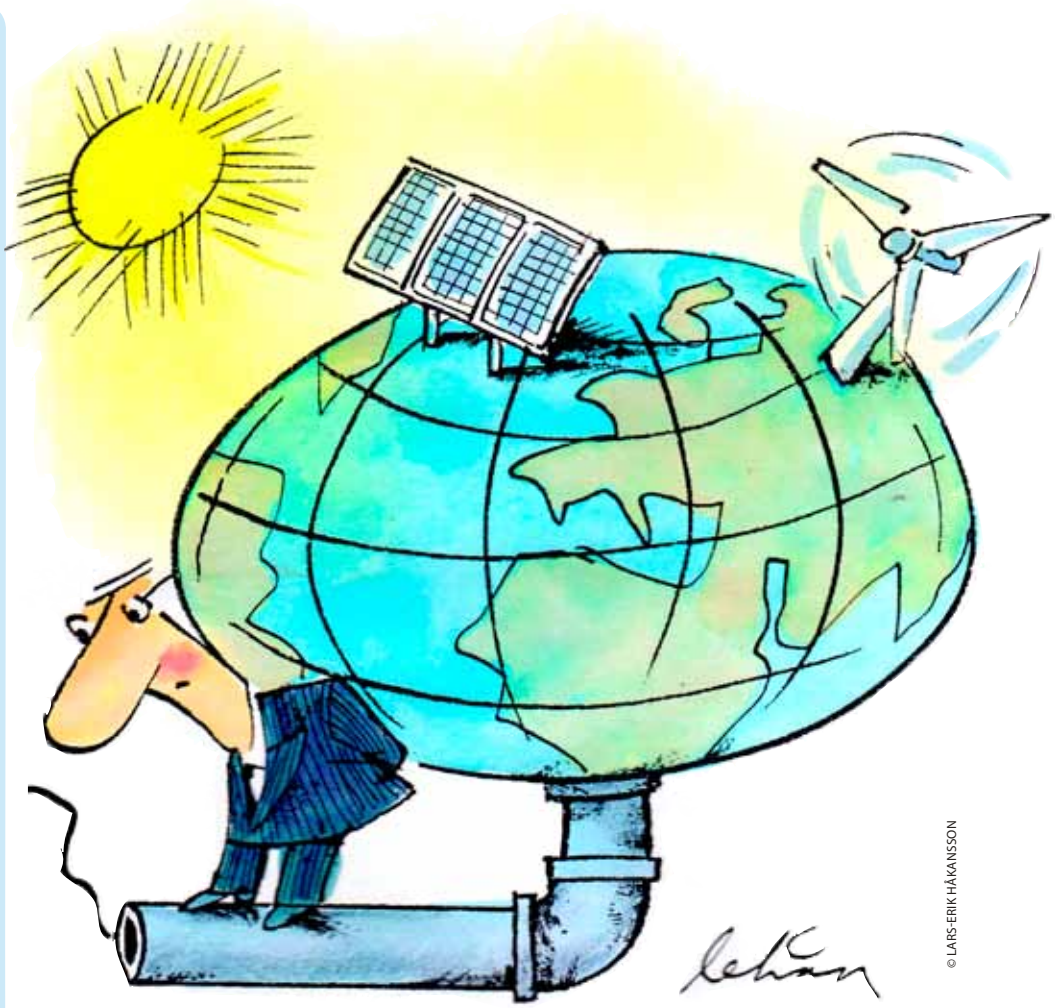

Bridge to nowhere

Is natural gas a "bridge" to a sustainable energy system? That is what the gas industry has been saying for decades. But the bridge is not needed. Sustainable technology is here now.

From 1980 to 2010, natural gas use almost doubled in Europe. European coalmines were uneconomic, and were closed down one after the other.

The fuel shift was also, to some extent, policy-driven. Gas was seen as cleaner than coal, especially for power. Indeed it is.

The supply of gas from the North Sea was shrinking, but gas from Russia and Norway made up for that loss. More imports from other countries that have LNG was another option.

Gas was certainly nowhere near as divisive as nuclear power, so the road from coal to gas was taken for granted. Most European leaders thought renewables a very nice idea, and supported them with generous feed-in tariffs or by other means. Everybody also had a kind word for efficiency. But few thought that it or renewables would have any real significance in the foreseeable future.

Gas is the bridge. That was what most politicians thought, and that was what the power companies thought. Other bridges to the future were carbon capture and storage, and for some leaders also nuclear power, either conventional or

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Acid News

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

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

In order to 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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Printed by Trydells Tryckeri, Laholm, Sweden.
ISSN 0281-5087.

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

AirClim

Greenhouse gas emissions must be reduced drastically to avoid dangerous climate change due to rising global temperature and to fulfil the objective of the 1992 UN Climate Convention. Dangerous climate changes occur, for example, when coastlines and island states disappear due to sea-level rise, global ecosystems such as coral reefs, arctic and high mountain ecosystems become extinct, or ocean acidification due to CO_2 uptake reaches a tipping point at 1.5°C of global temperature rise. In hearings held by the EU Commission, scientists from the Potsdam Climate Institute said that only 10 per cent of the world's coral reefs would survive a global temperature increase of 1.5°C.

"greenhouse gas emissions must be reduced globally by more than 95 per cent by 2050, and in the European Union by 2030"

At the Geneva UN Climate Negotiations in February 2015, scientists made it very clear that even with the present temperature increase of 0.8°C, climate change effects are real and that each further 0.1° increase will cause serious climate change. A WHO representative said in Geneva that a 1.5°C level of warming is projected to lead to very large increases in health risks in comparison with the current levels of risk. In Geneva the 46 countries that make up the Alliance of Small Island States (AOSIS) once again called for a UN target of "well below 1.5 degrees". The 1.5 target is supported by more than 100 countries in the UN. In Geneva, AOSIS demanded a 70–95 per cent global reduction in greenhouse gases by 2050 and negative emissions after 2080, based on findings from the IPCC 5th Assessment Report from 2014. To achieve this target, the Climate Action Network, comprising more than 900 NGOs worldwide, is currently running a campaign to get agreement in the UN on a global target for 100 per cent renewable energy by 2050.

At current levels of carbon dioxide emissions, so much CO_2 will be emitted over the next two decades that temperatures will rise more than 1.5 degrees. This is the reason AOSIS is calling for measures that would remove CO_2 from the atmosphere later this century. The key measures are protection of the world's forests, drastically increasing the world's forest cover and developing sustainable agriculture and forestry methods that act as a CO_2 sink.

Fossil fuel use will have to be phased out in the next few decades worldwide. Carbon capture and storage technology, promoted by the fossil fuel industry, is still not a viable solution despite years of research and also faces strong opposition from citizens. AirClim has published several studies on CCS development, including articles in this issue (pages 9 and 18).

AirClim is demanding that greenhouse gas emissions must be reduced globally by more than 95 per cent by 2050, and in the European Union by 2030. AirClim calls on European governments to stop building new coal power plants from this year onwards. This is in line with statements from the International Energy Agency, which in 2013 demanded that by 2017 no new coal power stations should be built if the world wants to limit global temperature rise to 2 degrees, as agreed by the UN. AirClim also demands that all old coal power plants in Europe must be closed by 2030. AirClim will co-publish a documentary and campaign film in spring called "1.5 to stay alive" to underpin the above targets.

Reinhold Pape

Flexibilities threaten emission cuts from MCPs

Member states want to water down proposed new emission standards for medium-sized combustion plants, and there is now a risk that the European Parliament will push for even more exemptions.

Medium-sized combustion plants (MCP) should be given more lenient air pollution emission standards and extended compliance deadlines, according to the European Parliament's rapporteur, Andrzej Grzyb, Polish representative of the EPP.

A new directive to limit air pollutant emissions from combustion installations with a thermal input between 1 and 50 megawatts (MW) was proposed by the Commission as part of its air quality package from December 2013. The proposal covers nearly 143,000 MCPs now in operation in the EU, which in 2010 together emitted some 554 thousand tons (kt) of nitrogen oxides (NOx), 301 kt of sulphur dioxide (SO_2) and 53 kt of particulate matter (PM).

Even though the Commission's impact assessment showed that EU-wide application of the most stringent standards now used in member states would reduce NOx emissions from these plants by nearly 80 per cent by 2025, the proposed new directive would only deliver less than half of this reduction.

The Commission has calculated that its proposal would cost around €300 million a year between 2025 and 2030, but the health and environmental benefits would be ten times that figure.

Despite the modest ambition level of the Commission's proposal, discussions in the Council between member states are focussing on relaxing and delaying the emission standards, and draft position papers in the Parliament are heading in the same direction.

While the Commission's proposal imposes the same emission limit values (ELV) for all plants, independent of their capacity, Mr Grzyb wants a division into three categories with markedly less stringent ELVs applied to the smaller installations.

Mr Grzyb's draft position also introduces a large number of derogations, including a long list of plants that would be exempted from complying with the law, including recovery boilers used by pulp industry, gas turbines on offshore platforms, refineries, crematories and reactors in the chemical industry, as well as plants in remote island locations.

The Commission's proposal includes a derogation for peak-load plants, by which member states may exempt existing plants that do not operate for more than 500 hours per year from compliance with the ELVs. Mr Grzyb wants to significantly extend this, to 1,000 hours per year as a rolling average over a period of five years.

He further suggests toning down the Commission's proposal to oblige member states to apply stricter ELVs to plants in zones that do not comply with mandatory EU air quality standards by making it voluntary.

Environmental groups criticised the many exemptions and weaker emissions limits, saying these called into question how useful the law will be. In a comment on the outcome of the environment ministers' discussions in December, Christian Schaible of the European Environmental Bureau (EEB) said: "Ministers seem to be more concerned with providing derogations and extra flexibility for plant operators than with reducing the number of premature deaths in the EU due to air pollution".

Environmental and health protection organisations from across the EU have agreed a number of main priorities for improving the proposed directive, including to:

- Set ELVs in line with the Best Available Techniques (BATs);
- Bring forward the compliance deadlines for both new and existing plants;
- Address all MCPs, even when they are part of a bigger installation covered by the Industrial Emissions Directive;
- Set ELVs for other pollutants, such as mercury, formaldehyde and methane;
- Reject the shopping list of derogations suggested by the Council.

The Parliament's Environment Committee is scheduled to vote on the matter on 13–14 April.

Christer Ågren

Sources: ENDS Europe Daily, 17 December 2014 and 9 February 2015.

NGO Position paper: Recommendations to clean up air pollution from Medium Combustion Plants (23 February 2015). Link: *http://www.eeb.org/index.cfm/library/cleaning-up-air-pollution-from-medium-combustion-plants/*

EU Parliament in action.

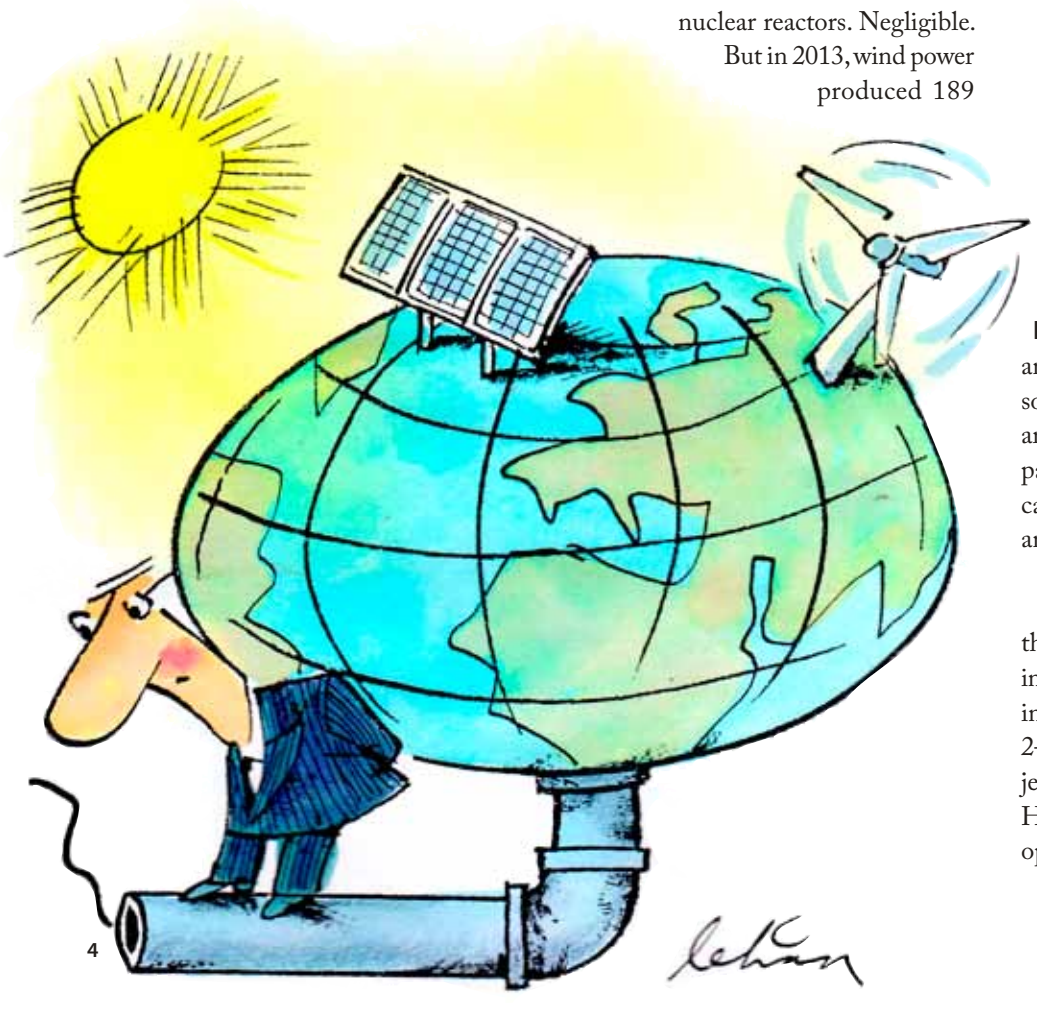
Bridge to nowhere

Continued from front page

more "advanced" concepts such as thorium reactors, fast breeder reactors, and fusion.

This time perspective – of CCS now, together with more nuclear and more gas, and followed by sustainability sometime in the future – has turned out to be 180 degrees wrong.

- The nuclear renaissance did not come. Nuclear production in the EU peaked in 2004, and has dropped 13 per cent since then. More reactors will be retired over the next few years. Only four reactors are under construction in the EU, two of them Soviet-era projects in Slovakia. "Advanced nuclear" is moving further and further into the future.
- CCS failed. Both the EU and member states have offered very large sums of money, but there are no takers. There is no coal power CCS anywhere in the world now or in the near future. The few CCS projects that are running or likely to be underway in the near term are of two kinds. One separates CO_2 from natural gas, which is beside the point. The other uses CO_2 for enhanced oil recovery, which means more CO_2, not less. None of them are in the EU, anyway.
- Gas sales have dropped since 2010, and especially for power. Industry use and domestic use for heating do not change so fast, but power plants can be switched on and off at very short notice. If the gas price is high and the power price is low, they will run much fewer hours per year. Gas prices are falling, but not enough to stop the decline. The relative cleanliness of gas also raised more question marks after the US boom in fracking. European fracking efforts have damaged the image of gas, but produced no actual gas. And the security of supply issue resurfaced with the Ukraine crisis, if not before. The bridges have crumbled, but the distant shore has moved within wading distance.
- Efficiency improvements have cut electricity use by some five per cent between 2010 and 2014, i.e. not because of the 2008 recession, but after it. There may be a thousand reasons, from LEDs to better fridges, fans and pumps, much as a result of EU and US policy.
- Wind power became mainstream. In the year 2000, Europe got 21 TWh from wind, worth two or three standard nuclear reactors. Negligible. But in 2013, wind power produced 189 TWh, equivalent to 25 reactors. That is not negligible, and it is only the beginning. Denmark got 39 per cent of its electricity from the wind in 2014, Portugal 24 per cent. In France, Germany and Spain, wind produced more energy than gas during 2014.
- Wind power is now competitive with any other new power technology, and even threatens existing coal, nuclear and gas power by driving wholesale electricity prices down.
- This is also happening for solar. In 2014, Germany got 33 TWh from solar. This is not an awful lot, but solar production is already big enough to push peak power prices down in the daytime. That is when the big power stations used to earn most money. Solar is coming fast. The EU produced just 0.1 TWh in the year 2000, but 83 TWh in 2013. Italy got 23 TWh from solar in 2014. According to Deutsche Bank , 80 per cent of the world will have "grid parity" before 2017, meaning that homeowners will save money by putting solar panels on their roofs, irrespective of politics.
- Just a few years ago photovoltaic development was an almost exclusive European thing, very dependent on policy in Germany, Spain and Italy. Now the skyrocketing production is heading to China, Japan, India, the US and South America, and the cost keeps falling. No policy decision can stop this development, though active policy can, and will, accelerate it.



From the investor perspective, solar and wind are attractive for several reasons. Solar is predictable. Most projects are built on time and on budget, and the panels then deliver the energy that was calculated. There is no technology risk and no fuel cost risk.

Wind power is almost as safe.

Coal and nuclear power projects, on the other hand, have often disappointed investors. The few nuclear reactor projects in the EU are all far behind schedule and 2–3 times over budget. Coal power projects are much the same. Vattenfall's giant Hamburg-Moorburg plant is not yet fully operational, but cost underestimates and

power price overestimates have forced a write-down of 1 billion euro. Vattenfall also lost 5–6 billion euro on Dutch Nuon, with coal and gas assets.

Eon did bet high on gas, and lost. Its Irsching 4 and 5 power stations are among the most modern and efficient in the world, but are still not making any money. Power prices are too low, and natural gas is too expensive to compete with anything, for most of the year.

Eon actually threatened suicide, i.e. closing down the Irsching plants. They got some money from the grid authority to keep them for strategic reserve power.

In the rear-guard fight for big power, this suicide strategy became institutionalized. It is called "capacity market" and means that the government pays for fossil and nuclear power capacity whether it is used or not. In the UK, the compensation (for delivery winter 2018) is £19.4/kW according to an auction in December 2014. Most of the money goes to existing gas power and some to coal, so many NGOs see it as a fossil subsidy. Some also goes to nuclear, but very little for demand reduction.

In Germany, the government has had second thoughts and Sigmar Gabriel, Minister for Economic Affairs, told the press that he sees no rationale for a capacity market. Prices will fluctuate more, but those swings will spark new investments, he said.

He did not elaborate, but those investments are likely to be electric storage, more power lines, biopower and demand-side management. Not fossil gas power.

Germany is a densely populated country with modest renewable resources. Hydropower dams acts as a battery, but Germany does not have much of it. Most countries have a better match between solar supply and demand. So if Germany can keep adding renewables, phase out nuclear and fossil fuels, including natural gas, and still keep the grid stable, then the whole world can do so.

Fredrik Lundberg

Falling costs for renewable energy

A report from the International Renewable Energy Agency (IRENA) highlights the plummeting costs for renewable energy – making renewable energy more competitive then ever.

According to the IRENA report, "Renewable Power Generation Costs in 2014", the cost of generating power from renewable energy sources has reached parity or dropped below the cost of fossil fuels for many technologies.

Biomass, hydropower, geothermal and onshore wind are all competitive with, or cheaper than, coal, oil and gas-fired power stations – cheaper even without financial support and despite falling oil prices. Solar photovoltaic (PV) is the most competitive, with solar PV module costs falling 75 per cent since 2009 and the cost of electricity from utility-scale solar PV dropping by 50 per cent since 2010. Residential solar PV systems are now 70% cheaper than they were in 2008.

In Europe and other countries, onshore wind power is one of the most competitive sources of new electricity capacity available. Individual wind projects are consistently delivering electricity for US$ 0.05 per kilowatt-hour (kWh) without financial support, compared to a range of US$ 0.045 to 0.14/kWh for fossil-fuel power plants.

When damage to human health from fossil fuels in power generation is considered in economic terms, along with the cost of CO_2 emissions, the price of fossil fuel-fired power generation rises to between US$ 0.07 and 0.19/kWh.

For 1.3 billion people worldwide who do not have electricity, renewables are the cheapest source of energy and they are also advantageous in cost and security for islands and other isolated areas mainly reliant on diesel.

In 2013, a record-high 120 gigawatts of renewable energy was added to the global energy mix and similar forecast exists for 2014. Similarly, renewable energy accounted for 22 per cent of global electricity generation and 19 per cent of total final energy consumption in 2013.

Renewables are the cheapest alternative for communities not yet electified.

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The continuously falling price of renewables and the clear business case for renewables present a historic opportunity to build a clean, sustainable energy system that contributes to human health and combats climate change.

Miriam Markus-Johansson

Source: *www.irena.org/publications and http://www.irena.org/News/Description.aspx?NType=A&mnu=cat&PriMenuID=16&CatID=84&News_ID=386#sthash.4REHWcyF.dpuf*

EU industrial air pollution cost up to €189 billion per year

The cost of damage caused by pollutant emissions into the air from the largest 14,000 industrial facilities in 2012 has been estimated as at least €59-189 billion, and half of the total cost was caused by just one per cent of the industrial plants.

Based on data from the European Pollutant Release and Transfer Register (E-PRTR), a recent study published by the European Environment Agency (EEA) assessed the costs of damage to health and the environment from pollutants emitted by industrial facilities in the EU 27 member states, Norway and Switzerland.

Many different air pollutants were covered, including the traditional regional air pollutants (sulphur dioxide, nitrogen oxides, particulate matter, ammonia and volatile organic compounds), heavy metals, organic compounds and the greenhouse gas carbon dioxide.

Over the five-year period 2008–2012, the aggregated cost of damage from these emissions was between €329 billion and €1,053 billion.

Facilities covered by the analysis include large power plants, refineries, manufacturing combustion and industrial processes, waste and certain agricultural activities. It was found that the energy sector (power plants) contributed the largest share, about two-thirds, of the costs. Other significant contributions came from production processes and combustion in manufacturing.

Emissions from several sectors, such as transport, households and most agricultural activities, were excluded from the study. If these were included, the cost of air pollution would be even higher. For comparison, the European Commission recently estimated that solely the health damage costs from the main traditional air pollutants emitted from all sectors in the EU amounted to €330–940 billion for the emission levels of year 2010.

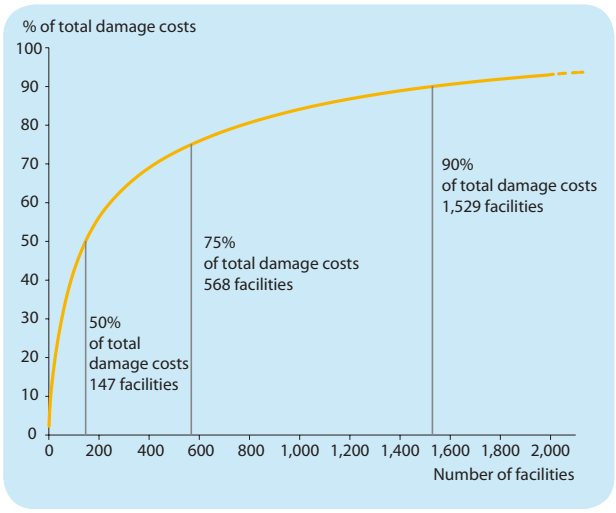

Figure 2. Cumulative distribution of the 2,000 E-PRTR facilities with the highest damage costs 2008–2012.

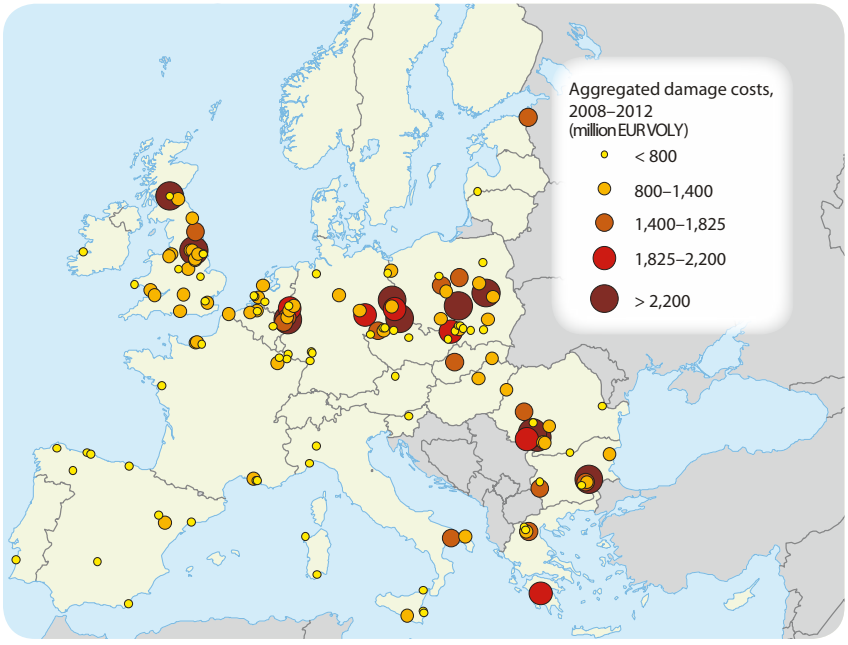

Figure 1. Locations of the 147 E-PRTR facilities that caused half the total damage costs in 2008–2012.

For traditional air pollutants, the EEA study estimated the cost of health damage by using damage costs per tonne of each emitted pollutant as a national average for each country. Specifically for mortality impacts, a lower and a higher value were used, the former being based on the value of a life year lost (VOLY) and the latter on the value of a statistical life (VSL).

As it has proven very difficult to value damage to ecosystems in monetary terms, ecological damage from acidification, eutrophication or ground-level ozone was not accounted for. Neither was air pollution damage to the cultural heritage.

Valuation of carbon dioxide (CO_2) emissions was based on modelled carbon price forecasts for the EU's Emissions Trading System (ETS), with a lower value of €9.5 per tonne and a higher value of €38.1 per tonne. While these figures are within the range of US$4–95 per tonne identified by the IPCC in 2007, they are significantly lower than figures calculated by the Stockholm Environment Institute (SEI). According to the SEI's worst-case calculations, the social cost of CO_2 could be almost US$900 per tonne in 2010, rising to US$1,500 in 2050.

The proportion of CO_2 damage costs as a fraction of the total damage costs varies widely, from 12 to 62 per cent, depending

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ABOVE: Turceni a lignite-fired power plant in Romania.

RIGHT: Table. The top twenty plants estimated to have the greatest damage costs from air pollutant emissions in 2008–2012.

Number	Facility name	Country	Activity	Aggregated damage cost 2008–2012 (EUR2005 million)
1	Maritsa 2	Bulgaria	Thermal power station	7,465-22,394
2	Bełchatów	Poland	Thermal power station	5,997-14,126
3	Turceni	Romania	Thermal power station	4,916-13,761
4	Jänschwalde	Germany	Thermal power station	3,498-8,165
5	Drax	United Kingdom	Thermal power station	3,482-8,039
6	Rovinari	Romania	Thermal power station	3,198-8,844
7	Turów	Poland	Thermal power station	2,797-6,925
8	Kozienice	Poland	Thermal power station	2,667-6,580
9	Niederaußem	Germany	Thermal power station	2,276-4,172
10	Longannet	United Kingdom	Thermal power station	2,226-5,761
11	Romag Termo	Romania	Thermal power station	2,117-6,022
12	Schwelgern	Germany	Iron and steel production	2,048-5,316
13	Megalopolis A	Greece	Thermal power station	1,872-5,103
14	Rybnik	Poland	Thermal power station	1,870-4,574
15	Lippendorf	Germany	Thermal power station	1,832-4,368
16	Boxberg	Germany	Thermal power station	1,829-3,976
17	Mintia	Romania	Thermal power station	1,819-5,066
18	Nováky	Slovakia	Thermal power station	1,814-5,003
19	Prunéřov	Czech Republic	Thermal power station	1,690-4,063
20	Neurath	Germany	Thermal power station	1,670-2,975

on valuation (higher or lower) used for the various pollutants.

Some key findings:

- A small number of individual facilities cause the majority of damage costs. Three-quarters of the total costs were caused by the emissions from just 568 industrial facilities – four per cent of the total number (see figure 2).
- The dirtiest plants are all coal-fired power stations, including Maritsa 2 in Bulgaria, Belchatow in Poland, Turceni in Romania, Jänschwalde in Germany, and Drax in the UK (see table).
- Eight of the 30 dirtiest facilities are located in Germany; six in Poland; four in Romania; three each in Bulgaria and the United Kingdom; two in Greece; while the Czech Republic, Estonia, Italy and Slovakia all have one each.
- Annual damage costs could be cut by at least €11-33 billion if the listed 1500 large combustion plants (LCPs) were to meet the emission limit values for SO_2 and NOx set in the Industrial Emissions Directive.
- If the listed 1500 LCPs were (hypothetically) to achieve the stricter BAT-associated emission levels for SO_2 and NOx described in the 2006 LCP best available techniques reference document (BREF), annual damage costs could be cut by €19–55 billion.

The report reveals the very high cost caused by pollution from power stations and other large industrial plants, and the results will now feed into ongoing EU discussions on air quality legislation, including the revision of the LCP BREF and the revision of the National Emission Ceilings Directive.

Christer Ågren

The report "Costs of air pollution from European industrial facilities 2008–2012 – an updated assessment." EEA Technical Report No 20/2014 (25 November 2014).

Link EEA: *www.eea.europa.eu/media/newsreleases/industrial-air-pollution-has-high*

Link EEB: *www.eeb.org/EEB/?LinkServID=FDF2410C-5056-B741-DB02046D1436613A*

Air pollution prevails in Germany

In 2014, levels of nitrogen dioxide (NO_2) exceeded the EU air quality limit value at about half of the monitoring stations on busy roads, according to preliminary evaluations by the German Federal Environment Agency (UBA). This share is expected to increase significantly when additional data from more stations will be incorporated in May.

Motor vehicle emissions are the main source of nitrogen oxides, and the Euro 6 car emission standards that came into force last year must help to cut these emissions in real-life driving, not just in laboratories, the head of the UBA, Maria Krautzberger said.

Another air pollutant of concern is particulate matter (PM). Although PM concentrations were lower than in previous years, EU air quality standards for PM_{10} were exceeded at one-tenth of traffic-related monitoring sites. However, almost half of all stations exceeded the World Health Organizations' recommended PM_{10} level, which is tighter than the EU limit value.

Maria Krautzberger sees no reason for complacency: "Despite lower PM levels, the health risk remains. As there is no safe threshold level for PM, health damage occurs even at low concentrations."

UBA notes that the share of PM emissions from household wood combustion is increasing, and in the winter months may contribute up to 25 per cent of PM concentrations.

Source: UBA press release, 9 February 2015

German experts: Nitrogen cuts urgently needed

Excessive emissions of nitrogen compounds into the environment pose a threat to human health, waterways, biodiversity, and the climate.

The release of too much nitrogen pollutants into the environment is one of the biggest problems of our time, according new report on nitrogen by the German Advisory Council on the Environment (SRU).

Nitrogen compounds, such as nitrogen oxides and ammonia, pollute the environment and endanger human health in numerous and complex ways:

- Nitrogen-induced eutrophication and acidification contribute to biodiversity loss.
- Nitrogen dioxide in ambient air damages human health directly, contributes to ground-level ozone formation, and together with ammonia forms hazardous particulate matter.
- Nitrate in drinking water and food endangers human health; nitrosamines are suspected of being carcinogenic.
- Nitrous oxide damages the ozone layer and contributes to climate change.

The SRU reports that nearly half of Germany's natural and semi-natural terrestrial ecosystems are exposed to nitrogen deposition exceeding the critical limits for eutrophication, and 8 per cent are subject to excess acid deposition. Around 27 per cent of all German groundwater bodies exhibit a poor chemical status. And the annual limit value for nitrogen dioxide in ambient air is exceeded at more than two-thirds of locations in cities.

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Nearly half of natural and semi-natural terrestrial ecosystems receive too much nitrogen.

"Policy-makers need to address this major environmental problem with greater effort than in the past," said Professor Karin Holm-Müller, deputy chair of the SRU, at the release in January of the new nitrogen report. If Germany is to meet current national and international environmental quality objectives, nitrogen emissions will have to be reduced by at least 50 per cent, according to the SRU.

The report contains more than 40 recommended measures. The top priorities are:

- Amending the German Fertilizer Regulation, which would regulate the use of digestate and liquid manure, offers the chance to reduce nutrient spreading and at the same time roll back nitrate, ammonia and nitrous oxide emissions. Hence it could promote clean air, clean water, and climate protection. While the December 2014 draft bill would be a major step forward, it is not sufficient.
- Supplementing existing regulations by imposing an environmental tax on surplus nitrogen in the agricultural sector.
- Strengthening of EU clean air policies, in particular strict emission reduction targets for ammonia and nitrogen oxides for 2030 under the National Emissions Ceilings Directive.

In the interest of endowing this issue with more political clout and making the public more aware of the problem, the SRU recommends that a nitrogen strategy be jointly developed by the federal government and Germany's regional-state governments.

Christer Ågren

The summary report "Nitrogen: strategies for resolving an urgent environmental problem" can be downloaded from www.umweltrat.de. The full report titled "Lösungsstrategien für ein drängendes Umweltproblem" is only available in German.

Norwegian CCS ambitions might move to the EU

Norway wants an agreement with the EU on collective delivery of a common climate target. This could make it easier to finance a full-scale CCS plant in one of the EU member states.

In early February 2015, the Norwegian government published a White Paper on its climate policies. The government states among other mitigation measures that its ambition is to build a full-scale demonstration Carbon Capture and Storage (CCS) plant. However, it avoids saying how, where and when. In reality, the government does not promise anything tangible. It will for example "continue to investigate the possibilities for a full-scale demonstration of CCS in Norway" before 2020. It will also "continuously evaluate the possibilities for a full-scale demonstration of CCS in other countries".

The part of the White Paper that attracted the most publicity was the agreement between the Norwegian government and the European Union to become part of the EU "climate bubble". This means that Norway wants to adopt common climate goals with the EU, and share the responsibility for reaching them. In consequence, the government is raising its climate mitigation goal from 30 to 40 per cent reduction by 2030 compared to 1990. Three different conditions have to be met:

- Norway should conclude an agreement on common implementation of climate mitigation goals with the European Union. The parties to the UN climate agreement to be signed in Paris in December 2015 should accept that Norway implements its contribution to the UN climate agreement in co-operation with the EU.
- Through an agreement with the European Union, Norway should have the possibility to cover parts of its contribution for the non-quota regulated sector under the same conditions as the other countries in the EU.
- Alternatively, without an agreement with the European Union, the system of flexible mechanisms from the Kyoto Protocol will continue in some form under a UN climate agreement for the period 2013 to 2020, and Norway should have the opportunity to cover parts of its contribution through these mechanisms.

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Norwegian technology for export.

It goes without saying that the government may not feel obliged to fulfil the 40 per cent reduction goal by 2030 if none of these conditions are met.

If an agreement is reached with the EU, this also opens up new possibilities for the Norwegian implementation of its climate goals. It could, for example, be easier to finance part of a full-scale demonstration CCS plant in one of the EU countries, rather than building one in Norway. Or it could buy EU climate certificates to cover a large part of its emissions. Both could then be counted as part of Norway's contribution to achieving the common climate goal with the EU under the UN climate agreement.

Nothing will be concluded in 2015, maybe not even in 2016. A finalization of the agreement between Norway and the EU will have to wait for the EU climate regime to be agreed internally. The likely outcome of the Paris negotiations in December this year will be a framework agreement. A continuation of the flexible mechanism will probably be decided later.

Becoming part of the EU climate bubble may cause further delay in the implementation of Norwegian internal climate measures, but some NGOs in Norway, such as Bellona, consider this to be the better of two evils: No Norwegian effective climate policies outside the EU climate regime, or hopefully in the longer term implementation forced by the EU institutions and compliance regime. Other NGOs are undecided; the debate has barely started.

Tore Braend

APC 32 Carbon Capture and Storage in Norway – The moon landing that failed can be downloaded at: *http://www.airclim.org/publications/carbon-capture-and-storage-norway-%E2%80%93-moon-landing-failed*

Modest growth of renewables in EU area

An EEA report shows modest growth in renewable energy consumption with a dominance by PV and wind in 2013. Another study claims that the integration of around 60 per cent renewables into the European electricity system could be feasible by as early as 2030.

According to the European Environmental Agency (EEA) report, the EEA data for 2013 shows that the EU-wide share of gross final renewable energy systems (RES) consumption continued to increase between 2012 and 2013, although at a more modest rate than recorded between 2011 and 2012. The EEA finds that in 2013 the share of gross final consumption of RES increased in all but one member state from 14.1 per cent in 2012 to 14.9 per cent in 2013. This progress enabled the EU to meet the 12.1 per cent indicative target for 2013–2014 in line with the Renewable Energy Directive (RED), as well as the 13.7 per cent expected EU-wide share for gross final renewable energy consumption in line with the National Renewable Energy Action Plans (NREAPs) adopted by countries.

The EEA report provides specific information at EU and national level on estimated RES progress in 2013, estimated gross avoided carbon dioxide (CO_2) emissions and avoided fossil fuel use due to the additional use of renewable energy since 2005, as well as an assessment of the statistical impacts of growing RES use on primary energy consumption.

The renewable heating and cooling market sector retained its dominance in the gross final consumption of all renewables in the EU. However, the renewable electricity sector grew faster and contributed the most to absolute growth in renewables use across all EU countries. By contrast, the use of RES in transport contracted in 2013 in about half of all member states and at EU level.

In recent years, the deployment of RES has increased strongly in the EU, from an 8.7 per cent share in gross final consumption in 2005, to 14.1 per cent in 2012. In absolute terms, final renewable energy use increased by 58 million tonnes of oil equivalents (Mtoe) over this period, at an average annual growth rate of 6.4 per cent (6.6% per year if only biofuels complying with the RED sustainability criteria are taken into account). From 2011 to 2012, the EU's RES consumption increased by 6.8 per cent, or roughly 10 Mtoe. This positive development was stimulated by national targets under the RED, the introduction of specific national support frameworks for renewables, and substantial cost reductions recorded by some modern RES technologies, especially solar PV. As such, renewables (mostly solar PV and wind) accounted in 2012 for almost 70 per cent of new electrical capacity added in Europe.

Regarding avoided fossil fuel use, EEA estimates show that the additional use of renewable energy compared to the level of RES consumption in 2005 enabled the EU to cut its demand for fossil fuels by 98 Mtoe in 2012 and by 116 Mtoe in 2013, respectively. In 2012, 12 member states saw reductions in their gross inland consumption of fossil fuels of 7 per cent or more, in response to RES increases since 2005 (Austria, Belgium, Denmark, Estonia, Germany, Finland, Italy, Latvia, Portugal, Slovenia, Spain and Sweden). The increase in renewable energy use since 2005 resulted in approximately 326 Mton of gross avoided CO_2 emissions at EU level in 2012, and 388 Mton in 2013, with most of these effects relating to sectors covered under the EU's Emissions Trading Scheme (ETS).

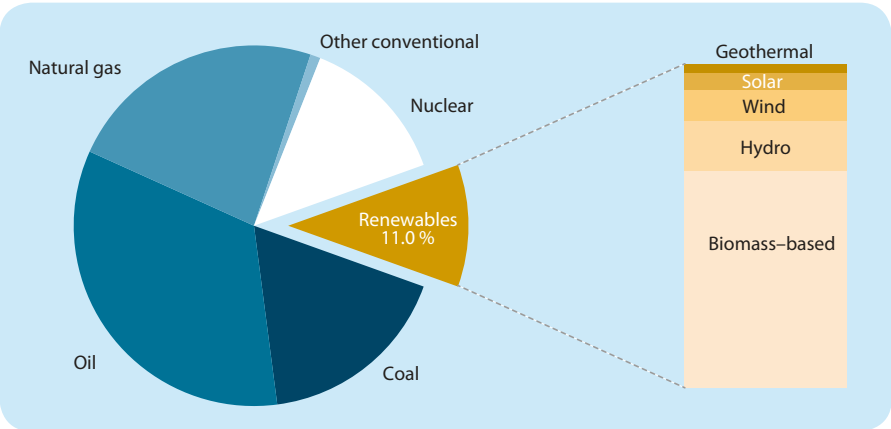

Figure 1. Shares in gross inland energy consumption (EU-28, 2012) Source: Eurostat, 2014b

RES mostly substituted coal (13%), followed by natural gas (7%), while the reduction in oil and related fuels was less pronounced, largely explained by the modest share of RES use in transport.

The drop in the pace of growth in 2013 occurred against the backdrop of less renewables used in transport (RES T) across 12 member states, along with slower growth in the renewable electricity (RES E) and renewable heating and cooling (RES H/C) market sectors. This slowdown is attributed to a slower growth of solar PV in the electricity sector, and of solid biomass in electricity and heating and cooling sectors, compared to the period 2011 to 2012.

The gross avoided CO_2 emissions at EU level due to the use of renewables in 2012 were estimated at approximately 326 Mton. This includes approximately 250 Mton (77%) in sectors covered by the EU ETS, and 75 Mton (23%) attained in non-trading sectors. These gross avoided emissions correspond to roughly 7 per cent of the EU's total GHG emissions in 2012, as shown in Figure 2.

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There was a slower growth of solar PV in 2013 compared to previous years.

Figure 2. Gross avoided emissions compared to total emissions (%), 2012

The progress in the use of RES contributes to the overall transition to a low-carbon society by 2050 as well as to attaining the intermediate climate and energy targets for 2020 and 2030. The EU has recently adopted three new EU-wide commitments for climate and energy for the year 2030: 1) a binding minimum 40 per cent domestic reduction in GHG emissions compared to 1990 levels; 2) a binding minimum 27 per cent share of gross final renewable energy consumption; and 3) an indicative minimum 27 per cent improvement in energy efficiency. RES are among the key contributors to this transition, being able to mitigate emissions of greenhouse gases (GHGs), lower other environmental pressures associated with conventional energy production and overturn the dominance of fossil fuels. This transition also leads to fewer environmental and health impacts; reduced reliance on fossil fuel imports; and improved competitiveness through boosting jobs, skills, innovation and green growth in the cleantech sectors of the future. The progress in the deployment of renewables during this decade has profound implications for the future path towards 2050. For 2050, EU leaders have endorsed the objective of reducing Europe's GHG emissions by between 80 and 95 per cent below 1990 levels, in line with proposals from the European Commission.

A recent study – titled Integration of Renewable Energy in Europe – by DNV GL (commissioned by the European Commission) claims that by 2030 it could be feasible to integrate around 60 per cent renewables into the European electricity system provided that the appropriate regulatory and infrastructure support is in place. The study emphasizes the need for RES expansion to be seen in the context of the EU Energy Roadmap 2050, which for instance comprises the 'Energy union' and a reduction in greenhouse gas emissions. Smart grid technologies are expected to play a pivotal role in the maturation of flexible grids due to their ability to minimize the need for distribution expansion. The report suggests that active voltage control by distribution networks and decentralized generators are both effective and feasible, and that the best way to handle solar and wind integration into the grid is to create a balanced geographical distribution, which would entail taking solar and wind capacities away from the best resource location and moving them closer to load centres, with cost-saving potential. In addition to wider application of technical measures, it also calls for extended use of market-based instruments, such as incentivizing the parallel expansion of renewable generation and network infrastructures, promoting a balanced distribution of decentralized generation, and promoting the development and use of innovative technologies.

Miriam Markus-Johansson

Source: Renewable energy in Europe — approximated recent growth and knock-on effects, EEA Technical report No 1/2015 (*http://www.eea.europa.eu/publications/renewable-energy-in-europe-approximated*)

Integration of Renewable Energy in Europe, DNV GL, (*http://www.pv-magazine.com/news/details/beitrag/renewables-could-feed-60-of-european-grids-by-2030--study-finds_100018327/#axzz3SqwLgvcw*)

Enforcement of ship sulphur standards

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Member states must carry out inspections on at least one-tenth of the ships calling each year, and test the fuel on at least 20–40 per cent of the inspected ships.

A new set of rules that require member states to check compliance with the EU's ship fuel sulphur regulation was agreed in December 2014 and published in February.

The new rules can be seen as a first response to increasing criticism about the lax regimes currently in place to ensure enforcement of environmental standards for international shipping, and is directly linked to the recent entry into force of the 0.10 per cent sulphur limit on marine fuels used within emission control areas (ECAs) as from 1 January 2015.

For Europe, the stricter sulphur standards mean that ships in the North Sea and Baltic Sea must use low-sulphur fuels or apply approved abatement technology to achieve equivalent emission reductions.

Rules concerning inspections, sampling methods and frequency, as well as reporting, are laid down in a Commission Implementing Decision, which states that sampling of marine fuel on board ships should be carried out either by analysing a fuel spot sample from the ship's fuel service system, or by analysing the relevant sealed bunker samples on board.

When it comes to sampling of marine fuels while being delivered to ships, this should target marine fuel suppliers who have been repeatedly found not to comply with the specification stated on the bunker delivery note.

Member states must carry out inspections of ships' logbooks and bunker delivery notes (BDN) on at least 10 per cent of the total number of individual ships calling in the relevant member state each year.

From 1 January 2016, member states must also carry out sulphur tests on the marine fuel being used on board on a certain percentage of ships calling at their ports. This varies from 40 per cent (of the minimum 10 per cent ships that are to be inspected) for countries fully bordering ECAs, to 30 per cent for those partly bordering ECAs, and down to 20 per cent for countries not bordering ECAs.

Establishing minimum inspection, sampling and reporting requirements is however only a first step – in order to ensure compliance there must also be penalties in place for non-compliance, but this issue is not part of the new inspection and reporting rules.

According to the EU sulphur directive, it is up to the member states to determine the penalties. It is stated that: "The penalties determined must be effective, proportionate and dissuasive and may include fines calculated in such a way as to ensure that the fines at least deprive those responsible of the economic benefits derived from their infringement and that those fines gradually increase for repeated infringements."

Over the past few years, there have been discussions in member states such as Denmark, Netherlands, Sweden and Finland on the need to introduce such penalties, and to ensure a workable and effective legal system to implement the sanctions.

However, it still appears uncertain how many – if any – member states have such "effective, proportionate and dissuasive" penalties in place. It is also not clear how many member states – if any – have a legal system in place that ensures that those found to be in breach of the standards will actually be made to pay the penalties.

Christer Ågren

Source: "Commission Implementing Decision (EU) 2015/253 of 16 February 2015 laying down the rules concerning the sampling and reporting under Council Directive 1999/32/EC as regards the sulphur content of marine fuels." Official Journal of the European Union L041. Link: *http://eur-lex.europa.eu/oj/direct-access.html*

US penalty policy for sulphur violations

On 16 January 2015, the US Environmental Protection Agency (EPA) released a penalty policy for violations of the sulphur emissions limit for ships operating in the North American and US Caribbean Sea Emission Control Areas. The policy is said to be intended to deter potential violators.

According to the memorandum, the EPA may impose a civil penalty of US$ 25,000 per violation, per day. Responsibility for burning compliant fuel, maintaining written procedures, recording the fuel change-over in the logbook, and retaining bunker delivery notes and samples of the fuel oil are all considered separate obligations, and thus involve separate violations if breached.

Notably, each day a violation continues constitutes a separate penalty of US$ 25,000. The penalties will be calculated "taking into account the nature, circumstances, extent, and gravity of the prohibited acts committed and, with respect to the violator, the degree of culpability, any history of prior offenses, ability to pay, and other matters as justice may require".

The EPA states that it is committed to enforcing marine emission standards to help prevent dangerous air pollution from harming public health in American communities.

US EPA info on ship fuel regulation: *http://www2.epa.gov/enforcement/marpol-annex-vi#marpol*

ECA compliance much cheaper than expected

As a result of the big fall in oil prices in the second half of 2014, compliance with the sulphur emission control area (ECA) regulation is less costly than originally expected. In January 2015, the price of ECA-compliant 0.10 per cent sulphur marine gas oil (MGO) in Rotterdam was under US$ 470 per metric tonne. That is roughly equivalent to the October 2014 price for low-sulphur intermediate fuel oil with around 1 per cent sulphur content. It is also some US$ 150 less than the price of high-sulphur heavy fuel oil in June last year when bunker prices peaked.

This means that, despite the tightening of the ECA sulphur limit from 1.0 per cent to 0.10 per cent as from 1 January 2015, the cost of running a ship in an ECA is now lower than it was in the first half of 2014, when the regulations were looser.

Source: Sustainable Shipping News, January 2015

The cost of running a ship in an ECA is now cheaper than a year ago.

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Poland must reduce PM_{10} levels

According to the Commission, the latest figures from Poland show that the maximum daily limit for fine dust particles (PM_{10}) – that should have been achieved since 2005 – is being exceeded in 36 zones, while the yearly limit is exceeded in 12 zones. In Poland, PM_{10} originate mostly in emissions from coal used for domestic heating, transport and by industry. Under EU law, member states are obliged to take all the necessary measures to improve air quality, and to make this information available in the form of air quality plans. The reasoned opinion issued by the Commission gives Poland two months to respond. Failure to act within the prescribed period may result in the Commission taking the matter to the EU Court of Justice.

Source: European Commission press release, MEMO/15/4489, 26 February 2015

Cleaner air would bring benefits in Turkey, Bulgaria, Serbia and Montenegro

In a series of briefing papers, the Health and Environment Alliance (HEAL) highlights the heavy toll on health resulting from exposure to poor air quality in Turkey, Bulgaria, Serbia and Montenegro.

Turkey has one of the highest rates of premature deaths due to air pollution in Europe. An estimated 28,924 people in Turkey died prematurely from exposure to elevated levels of particulate matter (PM) and ozone in 2010.

Despite having a population of only seven million people, Bulgaria is ranked number one in the EU in terms of annual premature deaths due to air pollution. Bulgaria's more than 11,000 premature deaths due to poor air quality can be compared with 4,000 deaths in Switzerland, a country with a similar sized population. In Serbia and Montenegro, 10,000 deaths are due to polluted air, with populations of seven million and 620,000 respectively. Romania ranks third, Poland ranks fourth and Hungary sixth.

Briefings in HEAL series on Air Quality can be dowloaded at *env-health.org/*

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Launch of Energy Union – mixed messages

The Commission proposes a range of policy and legislative packages to realise the Energy Union in the next five years. Environmental organisations are critical of mixed messages, inconsistencies and continued reliance on fossil fuels.

The new EU policy on Energy Union set out in the Commission Communication Energy Union Package – A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy – is meant to help the EU to build an energy market that benefits consumers, ensure energy security, implement the appropriate infrastructure, ensure efficient energy supply, and attain close integration of renewables into the energy mix.

The Energy Union is based on five pillars/dimensions, which are:

1. Energy Security
2. Fully integrated EU Energy Market
3. Energy Efficiency
4. Decarbonising the Economy
5. Research, Innovation and Competitiveness

The Annex to the Energy Union lists actions that the Commission will undertake in the coming years to develop this framework. Some of the main points of the Energy Union include:

- Full implementation and strict enforcement of existing energy and related legislation.
- Action to ensure further resilience and diversification of energy supply. This comprises for instance a revision of the existing security of gas supply regulation until 2016, a comprehensive strategy for liquid natural gas, and enhancing access to alternative suppliers, including from the Southern Gas Corridor route, the Mediterranean and Algeria.
- Ensure that intergovernmental agreements comply fully with EU legislation and are more transparent.
- Improve the infrastructure, support implementation of major infrastructure projects and create an infrastructure forum with a view to supporting the energy market, integrating renewables and achieving security of supply.
- Introduce a new European electricity market design in 2015, coupled with legislative proposals in 2016 such as legislation on security of supply for electricity and a general review of the regulatory framework.
- Enhanced regional approaches and cooperation on market integration.
- Action to address internal market distortion including ensuring greater transparency over costs, energy prices and public subsidies.
- Greater energy efficiency including a review of energy-saving legislation and greater uptake of funds for renovating housing and retrofitting existing buildings for efficiency gains.
- Moving away from fossil fuels in the transport sector and speeding up energy efficiency in this sector. This includes promotion of efficient pricing of infrastructure and the roll-out of intelligent transport solutions.
- Roll-out of a climate and energy framework for 2030 with legislation to achieve the renewable energy and greenhouse gas reduction targets agreed in October 2014 (partly within the Emission Trading System). This will comprise a new Renewable Energy Package in 2016–2017.
- Develop a smart energy and climate-related Research and Investment Strategy for EU leadership.

EU energy ministers will discuss the package in Brussels on 5 March and at an informal gathering hosted by the Latvian Presidency on 14–16 April, before formally taking a position at the Luxembourg energy council on 11–12 June. EU environment ministers will also consider the Commission's plan at a meeting in Brussels on 6 March, while EU leaders will discuss it briefly at a European summit on 19–20 March.

The Energy Union package has had a mixed reception from the environmental movement and the general view is that the package is not adequate and even entails a number of conflicts.

For instance Greenpeace EU energy policy adviser, Tara Connolly, said: "The left hand doesn't know what the right hand is doing with this plan. The Commission says the EU should move away from fossil fuels but it also wants to chase after new gas supplies and doesn't rule out coal. Europe needs a coherent, joined-up plan if it's going to play its part against climate change and be the world number one in renewables." According to Greenpeace and other environmental organisations, the plan lays out a contradictory set of priorities for energy and climate policy for the coming years. It supports the need to cut carbon emissions and the role of renewable energy, but backs fossil fuels such as coal in the context of energy security.

The organisation Transport and Environment (T&E) is also critical, saying that although there are good intentions for cleaner cars and the electrification of transport, the package did not deliver on earlier promises to introduce CO_2 standards for trucks and buses.

Brook Riley, climate justice and energy campaigner at Friends of the Earth Europe is also disappointed, stating that: "The target European governments have agreed that reducing greenhouse gas emissions is based on outdated science, and assumes a 50:50 chance at best of staying below 2°C global temperature increase. People must not be duped into believing the EU is taking genuine action on climate change." Riley is also critical of the many references in the communication to gas, particularly as Europe has promised to cut emissions by up to 95 per cent by 2050. "If Europe would exploit the full potential of energy savings and renewables, much

Environmental organisations criticised the proposal for inconsistencies and called for a "coherent, joined-up plan" for the EU in order to tackle climate change.

higher emission cuts would be possible and we could leave the beaten track of fossil fuel dependency once and for all."

Both Friends of the Earth Europe and CAN Europe called on the EU to provide new, additional financial and technological support for climate action in developing countries. It is also vital to scale up support from the developing countries to secure a comprehensive global climate agreement in Paris in December that builds resilient communities and helps vulnerable people.

Miriam Markus-Johansson

Source: Energy Union Package *http://ec.europa.eu/priorities/energy-union/docs/energyunion_en.pdf*

Transport & Environment Press release 25 February 2015, *http://transenv.eu/1BSRRmd*

Greenpeace Press release 25 February 2015 *http://www.greenpeace.org/eu-unit/en/News/2015/Commission-releases-garbled-energy-union-plan/*

The Tree Content for Climate & Energy Communicators *http://treealerts.org/region/europe/2015/02/eu-plan-adds-momentum-to-global-energy-transition/*

Emission standards for wood heaters in the US

The US Environmental Protection Agency (EPA) has issued updated air pollutant emission standards for woodstoves and set the first-ever federal standards for hydronic heaters, wood-fired forced air furnaces and pellet stoves. The rule applies only to new appliances and will be phased in over a five-year period, giving manufacturers time to adapt their product lines to develop the best next-generation models to meet these new standards.

Emissions from new models will be reduced by roughly two-thirds, improving air quality and providing US$ 3.4–7.6 billion in public health benefits. This means that every dollar spent to bring cleaner heaters to market, will bring US$ 74–165 in health benefits. Consumers purchasing new models will also benefit from efficiency improvements, which means they will use less wood to heat their homes.

Source: US EPA press release, 4 February 2015

Existing sources ignored in US methane proposal

On 14 January the Obama Administration announced a new goal to cut methane emissions from the oil and gas sector by 40–45 per cent from 2012 levels by 2025. The US Environmental Protection Agency (EPA) will set standards for emissions of methane and volatile organic compounds from new and modified oil and gas production sources, and natural gas processing and transmission sources, but not for existing sources of emissions. EPA intends to issue a proposed rule in the summer of 2015, and a final rule will follow in 2016.

Environmental groups have criticized the plan, pointing out that the proposed rules would cover only new sources, but omit hundreds of thousands of existing oil and gas wells and other operations that are emitting methane right now. The Clean Air Act allows for the regulation of existing sources, and it is estimated that almost 90 per cent of projected 2018 emissions will come from existing sources.

Source: Environmental News Service, 14 January 2015

Bad air quality prevails

More than nine out of ten urban citizens in the EU are exposed to harmful levels of the air pollutants $PM_{2.5}$ and ozone.

Air pollution problems in Europe are still far from solved. While policies have improved air quality overall, air pollution is still the main environmental health hazard, resulting in high costs for healthcare, unhealthy workers and nearly 450,000 premature deaths in the EU in 2011 (see AN 4/14, p. 26).

The annual air quality report from the European Environment Agency (EEA) collates data from official monitoring stations across Europe. It shows that almost all city dwellers are exposed to pollutants at levels deemed unsafe by the World Health Organization (WHO).

Between 2010 and 2012, up to 93 per cent of city dwellers were exposed to fine particulate matter ($PM_{2.5}$) concentrations above WHO guidelines and up to 98 per cent were exposed to ozone levels above WHO guidelines.

While emissions of the main air pollutants in Europe have continued to decline over the last ten years, due to the complex links between emissions and air quality this has not always resulted in a corresponding reduction in pollutant concentrations in ambient air, especially for PM and ground-level ozone.

Some key findings for the different air pollutants covered by the report are given below and summarised in the table.

Particulate matter (PM) is the most serious air pollution health risk in the EU, leading to health damage and premature mortality. The EU limit and target values for PM_{10}, which should originally have been met by 2005, were exceeded widely in 2012, with the daily limit value being exceeded in 21 countries, and one-fifth of the urban population being exposed to PM_{10} concentrations higher than the daily EU limit value.

For 2012, the EEA report shows that 64 per cent of EU urban dwellers were exposed to PM_{10} concentrations that exceed the WHO guidelines, and 92 per cent of the urban population were exposed to $PM_{2.5}$ concentrations in excess of the WHO guidelines.

PM in ambient air originates both from primary particles emitted directly into the air and from secondary particles produced as a result of chemical reactions of PM precursor pollutants, namely sulphur dioxide (SO_2), nitrogen oxides (NOx),

92 per cent of the urban population were exposed to $PM_{2.5}$ concentrations in excess of the WHO guidelines in 2012.

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Table. Percentage of the urban population in the EU-28 exposed to air pollutant concentrations above the EU and WHO reference levels (2010–2012).

Pollutant	EU reference value	Exposure estimate (%)	WHO AQG	Exposure estimate(%)
$PM_{2.5}$	Year (25)	10–14	Year (10)	91–93
PM_{10}	Day (50)	21–30	Year (20)	64–83
O_3	8-hour (120)	14–17	8-hour (100)	95–98
BaP	Year (1 ng/m^3)	24–28	Year (0.12 ng/m^3)	85–89
NO_2	Year (40)	8–13	Year (40)	8–13
SO_2	Day (125)	< 1	Day (20)	36–43
CO	8-hour (10)	< 2	8-hour (10)	< 2
Pb	Year (0.5)	< 1	Year (0.5)	< 1
Benzene	Year (5)	< 1	Year (1.7)	10–12
Colour coding:	< 5 %	5–50 %	50–75 %	> 75 %

ammonia (NH_3) and volatile organic compounds (VOCs). New research shows that PM concentrations can be considerably reduced by additional cuts in agricultural NH_3 emissions.

Ozone (O_3) can cause respiratory health problems and lead to premature mortality. It can also damage vegetation, including forest trees and agricultural crops. Ozone is a secondary pollutant, formed from precursor pollutants, primarily NOx, VOCs, methane and carbon monoxide. Exposure in cities is very high – 98 per cent of EU urban inhabitants were exposed to ozone concentrations above the WHO reference level in 2012, while 14 per cent were exposed to concentrations above the laxer EU target value.

Moreover, in 2011, one-fifth of arable land in Europe was exposed to ozone levels higher than the EU's target value for vegetation protection, and only 12 per cent of the total agricultural area met the long-term objective (LTO) for ozone. The critical level set for protection of forests was exceeded across two-thirds of the total forest area in the EEA's 33 member countries.

Nitrogen dioxide (NO_2) is associated with mortality and morbidity. It is also a major cause of eutrophication (over-fertilisation that may negatively affect biodiversity and cause excessive plant and algal growth in marine ecosystems) and acidification. NO_2 also contributes to the formation of PM and ozone. In 2012, eight per cent of Europeans living in cities were exposed to NO_2 levels above the EU limit values, which are set at the same level as the WHO guidelines.

Eutrophication is still a widespread problem – 63 per cent of the EU's ecosystem areas and 73 per cent of the area covered by Natura 2000 protected sites were exposed to nitrogen deposition in 2010 that exceeded eutrophication limits.

Benzo(a)pyrene (BaP) is a carcinogen. In 2012, about one-quarter of the urban population in the EU was exposed to concentrations exceeding the EU target value, which must be met by 2013. As much as 88 per cent of EU urban citizens were exposed to levels above the estimated WHO reference level. The increase in BaP emissions in Europe in recent years, especially from domestic solid-fuel combustion, is therefore a matter of concern.

Sulphur dioxide (SO_2) causes acidification and contributes to PM formation. Emissions of SO_2 have been reduced significantly in recent years and 2010 was the first year that the EU urban population was not exposed to SO_2 concentrations above the EU limit value. However, more than one-third of the urban population was exposed to SO_2 levels exceeding the stricter WHO guideline. While exceedances of the critical loads for acidification have fallen significantly over the last few decades, excess acid fallout was still occurring in seven per cent of the EU's ecosystem area.

Carbon monoxide, benzene and heavy metal (arsenic, cadmium, nickel, lead, mercury) concentrations in outdoor air are generally low, localised and sporadic in the EU, with few exceedances of the limit and target values set by EU legislation. However, the deposition of heavy metals contributes to the build-up of these pollutants in soils and sediments, and since they are persistent in the environment they may bio-accumulate in food chains. Depositions of mercury are estimated to exceed the critical loads in more than half of the area of sensitive ecosystems in the EU.

Commenting on the report, EEA Executive Director Hans Bruyninckx said: "Air pollution is still high in Europe. It leads to high costs for our natural systems, our economy, the productivity of Europe's workforce, and most seriously, the general health of Europeans."

Christer Ågren

Air quality in Europe – 2014 report. EEA Report No 5/2014. Available at: *www.eea.europa.eu/publications/air-quality-in-europe-2014*

Carbon storage a dead-end

CCS could make sense for industrial emissions. Or, then again, maybe not.

CCS is a technological solution that was much hyped in the early 2000s, promoted by the George W. Bush administration, by UK and German governments, by the IEA and the European Union, and most of all by Norway and Vattenfall.

After a thousand conferences and PowerPoint presentations, all the efforts of the last 15 years can be summed up as follows: nothing happened, except for some enhanced oil recovery projects and three irrelevant projects in or by Norway, where CO_2 from natural gas processing was captured and stored.

If CO_2 is pushed into oil wells so as to squeeze out more oil, it obviously results in more CO_2 compared to no CCS. It is not an alternative or complement to renewable energy or more efficiency. It is not a bridge to sustainability. It is not mitigation.

Storage of CO_2 from natural gas processing, as in Snöhvit, Sleipner and In Salah, Algeria, (with Norwegian Statoil as one of three owners) is clearly an improvement on doing nothing. But the separation has to be done anyway, as CO_2 is not wanted in the product, natural gas. This CO_2 stream is miniscule compared with CO_2 emissions from combustion of fuels. The CO_2 content of a ton of raw natural gas is a few per cent, say 25 kg. But when you burn that ton of gas, it produces three tons of CO_2.

This is still optimistic, as not all gas processing plants are close to a good site for storage. Clearly this is no major way to stop climate change.

The really overwhelming CO_2 problem is emissions from power generation, especially coal power, and the CCS projects so far show next to nothing about its viability.

But because so much money, prestige and emotion have been invested in CCS, there is a widespread wish to find some corner where it might work.

Biomass CCS is one candidate. Burning biomass for power and heat does not add CO_2 to the atmosphere, but if you can burn biomass and then store the CO_2, you will get negative emissions!

The IPCC writes:

"Combining bioenergy with CCS (BECCS) offers the prospect of energy supply with large-scale net negative emissions which plays an important role in many low-stabilization scenarios, while it entails challenges and risks."[1]

The IPCC report is however very abstract and does not specify where and how BECCS might be feasible.

Biomass includes a wide range of materials: sewage sludge, household waste, demolition timber, waste products from forestry such as bark and branches, waste products from agriculture and the food industry, such as straw and olive pits, and finally dedicated biomass such as short-rotation coppice, eucalyptus and some grasses.

Almost all of these cost more to transport than coal, oil or gas, because they have a lower energy density. This means that biomass generally speaking is a local fuel, in the 1–100 megawatt scale, unlike the gigawatt scale for coal power, and several hundred-megawatt scale for gas power.

On the whole, biomass is more expensive than coal; it is simply cheaper to steal than to work. This also means that biomass is mainly used either for heat or as process fuel in the pulp industry or for combined heat and power, typically with an efficiency of 85 per cent. It is not, and should not be, often used in gigawatt scale power plants, because then some 60 per cent of the energy is wasted. There is not enough biomass in the world to allow for that on a large scale.

If there is no economic case for coal power CCS – and we do not see this happening anywhere in the world – there is even less of a case for biomass power or heat CCS, because there is an economy of scale. A hundred 20 MW or a thousand 2 MW separation units clearly cost more than one 2,000 MW plant. The same goes for transport to storage sites. It obviously costs more to build a thousand small storage sites than a single big one, and it even more obviously costs more to build CO_2 pipelines to a single big storage site from a thousand small plants than to build a pipeline from one big power plant.

It is not going to happen.

Other candidates for CCS are steel, cement, lime, mining, metals and paper/pulp industries. The idea[2] is that as they cannot reduce their emissions very much in any other way, so we have to use CCS there, especially if we emit too much before 2050.

The paper/pulp industry is similar to biomass power and heat. While collectively a large source of CO_2, both fossil and biogenic, the individual plants are much smaller as point sources of CO_2 than big coal power plants. They are spread out through the forests, and many are not near a suitable storage site. Plants use different technologies and differ in size and design, so the separation stage will have to be more individually tailored for each, at a substantial cost. There are some fairly big point sources.

Steel is produced either from ore or from scrap. Scrap re-melting is not much of a CO_2 source. Ore-based steel, on the other hand, is a major emitter because the reduction of iron oxides to iron metal almost always uses coal as a reductant. Some steelworks are very big point sources of CO_2. The three blast furnaces in Sweden emit 12 per cent of the national CO_2 emissions. But none of them are close to a potential CO_2 storage site, and even if they were, it is an enormous investment with no value chain in sight.

There are several cheaper, quicker and more long-term sustainable methods to address the issue. Reduce: better steel and better designs so less of it is needed. In many applications, steel can be substituted with lighter metals, ceramics, polymers or wood or carbon fibres. Recycling rates can be improved, and this is easier if the total use of steel is minimized. The blast furnace was invented 2,000 years ago and is far from an optimal design, even if it is considered as the only way to make iron from ore with coal. Real-world furnaces all over the world are often old and inefficient by any standard, and many were

built and maintained with large government subsidies for reasons of national prestige. They leak heat. Process control is not impressive. Scrap steel is thrown in as a method of cooling the melt. Instead of recirculating combustible gases to reduce the ore, they burn the gases and add more coal instead. Coke is a form of coal with especially high emissions, and could be replaced by direct coal injection. Even better would be to replace some coal with natural gas, biomass or hydrogen from electrolysis.

All such options would open up with stricter environmental legislation and/or higher price for coal and carbon. At present the whole European steel sector is subsidized by the ETS, as the steelworks get more CO_2 allowances than they can use.

End customers would usually not have a big problem with a slightly higher steel price, as it is seldom more than a very small part of the input cost, for example in the car or construction industries.

Cement contributes about 5 per cent of global CO_2 emissions. Cement factories are also big point sources of CO_2, for two reasons. One is that fossil fuels are used for heating, the other is that CO_2 is driven out of the limestone, which is inevitable if you use limestone as feedstuff.

Other feedstuffs that do not emit CO_2 are however possible. British Novacem[3] made promising tests with magnesium silicate. The process also uses much lower temperatures and thus less energy input. Part of the formula is magnesium carbonate, where the carbon is taken from the atmosphere. This could even result in a carbon-negative cement.

Novacem, a small spin-out from Imperial College, could not find venture capital to build a pilot plant and was sold off to an Australian company in 2012, after which nothing much was heard. Maybe the Novacem cement was not viable, maybe it just takes a lot more effort to compete against traditional Portland cement.

There are other ideas[4]. A different mix[5] of calcium/silica may cut emissions by more than half. Other feedstuffs are possible, such as fly ash from coal power.

Cement is mainly used to glue together the sand and stone in concrete, and makes up about 12 per cent of the weight. If buildings can be made lighter with the same strength, less concrete and less cement are needed.

Steel-reinforced concrete may not be the ultimate construction material. We use it because we are used to it. It is heavy and needs heavy machinery and vehicles for transport. It does a bad job of retaining heat in cold weather, or keeping it out in hot weather. The mechanical strength per weight is not impressive and it does not have good acoustic properties.

Transforming the building industry is one of the pillars of sustainability, but to do so requires a lot of tax-funded research, development and political focus in the face of a very conservative and not very research-intensive construction industry.

There are several cheaper, quicker and more long-term sustainable methods to reduce emissions from steel production than CCS.

JEAN-ETIENNE MINH-DUY POIRRIER/FLICKR.COM/ CC BY-SA

A high CO_2 price would help a lot, but will not be seen anytime soon. And according to the IEA[6], always a champion of CCS, the direct cost for the cheapest CO_2 capture method (oxyfuel) would be almost 40 euros per ton, not including costs for CO_2 transport and storage.

This translates to more than 50 euros, all-inclusive, and more than 100 euros in the pre-commercialization phase – assuming that the IEA is not on the optimistic side. Cement is a traded commodity, so no producer can compete if they have a much higher cost than the rest.

CO_2 emissions from cement can, however, be cut by other means, such as building regulations, environmental policy, standardization, requirements for energy efficiency, requirements under Green Building schemes etc. An approach to produce better buildings and building materials with a smaller carbon footprint could produce results pretty soon, but they would not include CCS.

There is just no credible market dynamics for cement CCS or indeed any other industrial CCS.

Such far-fetched ideas should be compared to what is actually being achieved in the power sector.

Wind power has produced 3,100 TWh globally between 2000 and 2013. If wind power replaces old coal power emitting 1kg CO_2 per kWh, that is three billion tons of CO_2 avoided, at least 50 times as much as all the CCS projects put together so far. Wind power production doubled from 2010 to 2013 and may double again by 2016 or 2017. Solar quadrupled between 2010 and 2013, to 125 TWh, and may quadruple again by 2016. Efficiency improvements also deliver results. Electricity consumption fell in the OECD between 2007 and 2013, thanks to more efficient lighting, fridges and TV sets.

Wind power works, solar works, the Ecodesign directive works. Right now. CCS does not.

Fredrik Lundberg

[1] IPCC Climate Change 2014 5AR, Mitigation, WG III, SPM p 21

[2] See for example: *www.parliament.uk/business/publications/research/briefing-papers/POST-PN-403/low-carbon-technologies-for-energyintensive-industries*

[3] *www.wbcsdcement.org/pdf/CSIForum2010/05%20Novacem%20at%20CSI%20Forum.14%20Sept%202010.for%20distribution.pdf*

[4] See e.g. *www.luxresearchinc.com/sites/default/files/International%20Cement%20Review%20Article_9-2014.pdf*

[5] *http://newsoffice.mit.edu/2014/stronger-greener-cement-0925*

[6] *http://ieaghg.org/docs/General_Docs/IEAGHG_Presentations/J._Davison_IEAGHG_-_Cement_IndustrySEC.pdf*

East German lignite at a crossroads

Lignite power in eastern Germany is disastrous for the climate and displaces more people than any other industry in Europe. Despite a target of 80 per cent renewable energy by 2050, phase-out plans are conspicuous by their absence.

Before 1990, East Germany mined 300 million tonnes (Mt) of lignite (brown coal) annually to cover 70 per cent of all energy needs. Inefficient power stations and antiquated factories wreathed in sulphurous smoke generated 100 terawatt-hours (TWh) of electricity per year.

Today, advanced-technology plants belonging to the Swedish Vattenfall AB produce two thirds of this grid energy from less than 80 Mt of lignite. Modernized power stations at Jänschwalde (recently upgraded to 2,998 MW net electrical generation) and Boxberg (939 MW of original capacity expanded by 1,475 MW) have been supplemented by dual-turbine configurations at Schwarze Pumpe (1,500 MW) and Lippendorf (1,750 MW, with lignite from the MIBRAG mining corporation).

Industrialization policy in eastern Germany has been widely ineffective, leaving a good deal of surplus electricity for export to other regions. Newly erected wind and solar farms have further increased total capacities, making the early retirement of lignite power plants now plausible.

Following Swedish government policy resolutions, Vattenfall announced on 30 October 2014 the intention of "investigating options for its German lignite mining and generation activities". The possible sale of these assets precludes any near-term reductions of lignite usage. To protect revenues for corporate debt reduction, CEO Magnus Hall has instead emphasized "the current and future importance of lignite-based generation for the local economy and the German energy policy". For now, a "close dialogue" has been pledged with the states of Brandenburg and Saxony as "key stakeholders for Vattenfall's activities in the Lusatia region".

The continuation of lignite power generation is reinforced by political intrigues. The Social Democrat Ulrich Freese from Brandenburg, a former national vice-chairman of the mining union IG BCE, remained on the Vattenfall supervisory board after being elected to German parliament (Bundestag) in 2013. His parliamentary IG BCE colleague Thomas Jurk, SPD minister of the economy in Saxony until 2009, is a ceremonious "honorary miner" of the lignite trade association DEBRIV. He shares this distinction with past chancellor Helmut Kohl and other influential politicians.

Germany's lignite reserves could sustain one quarter of national electricity generation for another two centuries. The Öko-Institut in Berlin has found lignite to be more competitive than coal or natural gas at ETS (EU Emissions Trading Scheme) prices below €40 per tonne. Attaining the government's 80 per cent renewable electricity target by 2050 would only provide 24 per cent of dependable grid supplies according to the German Energy Agency (dena). In addition to 9 per cent power storage and 25 per cent reduced demand, 60 per cent fossil fuel backup capacity would still be required to accommodate fluctuating solar and wind availability.

A megawatt-hour (MWh) of electricity generated from lignite adds about a tonne of carbon dioxide (CO_2) to the atmosphere. Since the enactment of nuclear phase-out legislation in 2011, German lignite mining output has increased by 8 per cent. On present fossil fuel usage trajectories, Germany's 40 per cent CO_2 reduction target for 2020 cannot be achieved in relation to 1990.

With a water content exceeding 50 per cent, lignite provides less heat per tonne than even wood chips. Generating one fourth of the country's electrical power therefore necessitates extracting a half-million tonnes of lignite per day from beneath five times the amount of overburden (topsoil and sand). Fertile agricultural regions such as Western Saxony, which once supplied the city of Leipzig with fresh produce, have been widely devastated by mining. Enduring hydrological disruption, the cumulative detriments of power plant effluents, and the decline of real estate valuations are not reflected on electric power bills. Government policies for lignite power generation are confronted with public awareness of mining landscape devastation that could be reduced by increasing renewable generation capacities.

German lignite plants comply with existing regulations for sulphur dioxide and particulate effluents. However, the residual pollutants from these large emission sources still constitute statistically relevant imperilments of human health. Without the activated carbon filters employed as standard equipment in the USA, furthermore, each lignite power station emits up to a half-tonne of toxic mercury per year.

The German lignite industry resettles the most people of any enterprise in Europe. Private property rights have been abridged by mining regulations that originated in the Third Reich. The inhabitants of threatened communities usually accept nominal financial compensation for confiscated property in preference to unsuccessful legal challenges.

Under the new Swedish government policies, 2,400 people living in Lusatian villages near the Polish border had hoped to be saved from resettlement by Vattenfall. However, the announced intention to sell the company's German lignite holdings includes all mining inventories. To the

Lippendorf is one of the Vattenfall lignite power plants that might soon be for sale.

DANNY-SOTZNY/FLICKR.COM/ CC BY-NC

southwest, a proposed MIBRAG 680 MW power project at the regional Profen mine probably will not be built because of growing competition from renewable energies. However, long-distance lignite deliveries have already begun to the recently acquired Buschhaus power station near the Volkswagen factory in Lower Saxony and to two plants in the Czech Republic. Long-term mining plans now imperil up to ten additional villages.

The Czech MIBRAG owner EPH has been negotiating the purchase of Vattenfall's lignite operations. Lusatian lignite might then be delivered across the border to power plants in Northern Bohemia, where a number of mining licenses will be expiring in the year 2022. In contrast to Germany, Czech mining law already prohibits expropriations of private property. MIBRAG could also begin mining near the city of Lützen for supplying lignite to the Bohemian region. Included in the path of possible devastation is the 12th century church at Röcken, the birthplace and gravesite of the philosopher Friedrich Nietzsche. MIBRAG has provided a €600,000 grant for the archaeological excavation of a nearby battlefield from the 30 Years' War, where the Swedish king Gustav II Adolphus was mortally wounded in 1632. The destruction of human settlements and historic sites might nevertheless be contested if the mined lignite was intended for delivery to commercial and foreign customers not essential to national energy security.

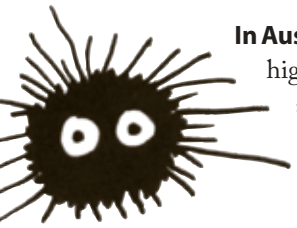
Reducing domestic lignite usage remains an eminent priority for climate target achievement. The environmental organization BUND (Friends of the Earth) has proposed legislation for shutting down Germany's 24 oldest lignite power plants mainly in the western Rhineland between 2016 and 2019. By decommissioning this least efficient half of the lignite power industry, up to 88 Mt/a of CO_2 emissions could be avoided to meet the 2020 greenhouse gas target of 749 Mt.

However, the Vattenfall Moorburg coal power station in Hamburg (8.5 Mt/a CO_2) will have meanwhile entered service. Solar and wind generation potential in East Germany is plentiful in the mining regions. Lignite plant retirements would immediately reduce CO_2 emissions.

Jeffrey H. Michel

Commission tells Austria, Germany, Slovakia and Bulgaria to act on air quality

Too many particles.



In Austria, PM_{10} levels are too high in the zone of Graz, and in Germany in the zones of Stuttgart and Leipzig. In Slovakia, six zones exceed the daily limit value for PM_{10}: Bratislava, Banskobystrický kraj, Košice, Žilinský kraj and Košický kraj.

Since these countries have failed to take necessary measures that should have been in place since 2005 to protect citizens' health, the Commission has issued reasoned opinions, in which the countries are requested to take forward-looking, speedy and effective action to keep the period of non-compliance as short as possible. If the countries fail to act, the Commission may refer the cases to the EU Court of Justice.

Moreover, the Commission has noted that citizens in two zones in Bulgaria have since at least 2007 been exposed to excessive levels of sulphur dioxide (SO_2).

While the measures taken in the south-west zone were efficient enough to achieve compliance with EU limit values in 2013, excessive levels persist in the south-east zone. If Bulgaria fails to act within two months, the case may be taken to the EU Court of Justice.

Source: European Commission press release, MEMO/14/2130, 26 November 2014.

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Achieving NEC targets will cost less

Achieving the Commission's health protection target for 2030 will be a third cheaper than previously estimated, according to new data.

After a series of bilateral consultations with member states' experts last year, providing updated information on national air pollutant emissions and projections, the Commission's consultant, IIASA, re-analysed scenarios for future emissions of air pollutants and found that the health protection target set out by the Commission for 2030 can be achieved at one-third less cost, from €3.3 billion to €2.2 billion.

The reason is that the new data shows that fewer new emission abatement measures will be needed to meet the EU's 2030 air pollution targets than expected when the EU's clean air package was proposed in 2013.

For example, the new data suggests a larger decline in emissions of primary fine particulate matter ($PM_{2.5}$) than previously expected. The revised baseline scenario for $PM_{2.5}$ now leads to a 32 per cent reduction from 2005 to 2030, instead of the 27 per cent decline that was estimated before. This, in turn, softens the emission reduction requirements for other air pollutants and results in reduced overall costs.

For the purpose of targeting reductions in health damage from $PM_{2.5}$ exposure, air pollutant emissions are converted into PM equivalents. The new figures show that about half of the PM equivalent emission reductions that emerge as cost-effective in 2030 were already achieved in 2012.

In 2030, current emission control legislation and projected activity changes in the baseline scenario are expected to achieve almost 90 per cent of the required sulphur dioxide (SO_2) reductions, and more than 95 per cent of the nitrogen oxides (NOx) reductions. Implementation of new EU legislation including the new directive on medium combustion plants and the revised directive on non-road mobile machinery, would result in additional reductions beyond what is expected to be delivered by current legislation that would largely fill the remaining gap towards the required reductions in SO_2 and NOx.

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New data suggests a larger decline in $PM_{2.5}$ emissions than previously expected.

For $PM_{2.5}$, current legislation is expected to deliver 60 per cent of the required emission reduction in 2030, and new or revised EU legislation would further deliver a large part of the additional reductions required.

With respect to ammonia (NH_3) and volatile organic compounds (VOC), current emission control legislation and projected activity changes resulting from the revised baseline would deliver about 30 per cent of the needed reduction in NH3 and 85 per cent of the reduction in VOCs.

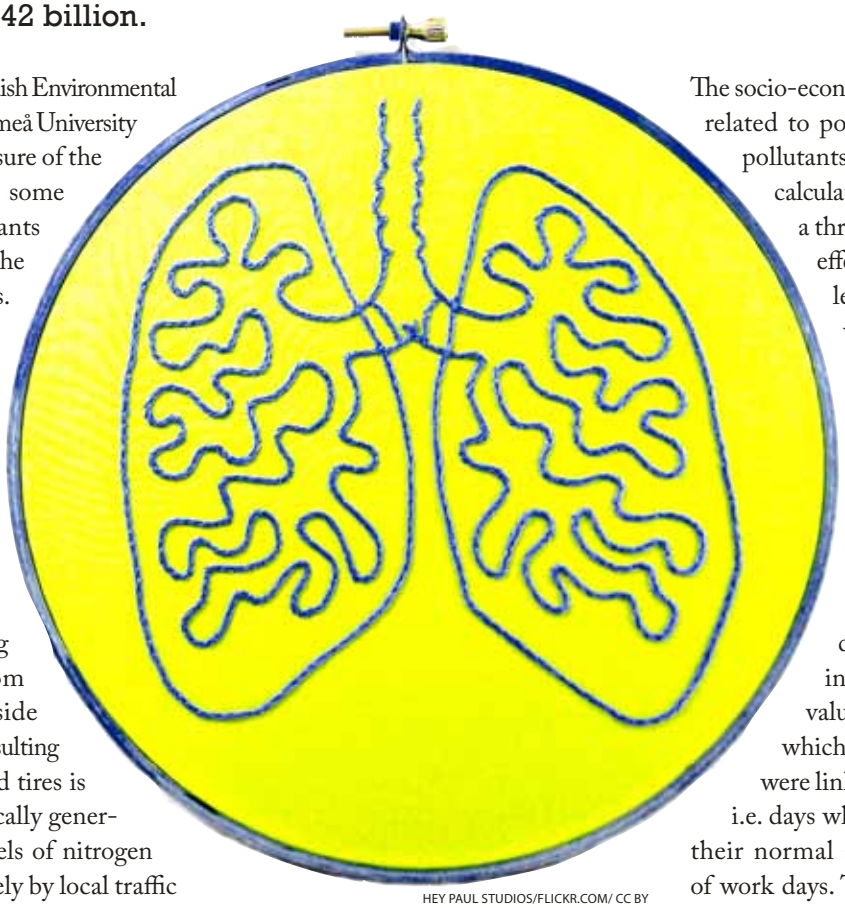
A recent study by the same consultants for the European Parliament (see AN 4/14, page 18–19) found that implementation of the EU's new 2030 climate and energy targets would lead to even bigger cost reductions for the proposed NEC directive, but those findings were not accounted for in the new analysis.

Christer Ågren

The report: Adjusted historic emission data, projections, and optimized emission reduction targets for 2030 – A comparison with COM data 2013 (January 2015). TSAP Report 16A, Version 1.1. Report to the European Commission by IIASA. Link: *http://ec.europa.eu/environment/air/clean_air_policy.htm*

Sweden: High health costs of bad air quality

Every year over 5,000 people in Sweden die prematurely due to air pollution, and the annual cost to society of health damage due to nitrogen oxides and particulate matter is estimated at SEK 42 billion.



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Health impacts from particles and NO_2 cause significant welfare losses.

A new study by the Swedish Environmental Research Institute and Umeå University has calculated the exposure of the Swedish population to some of the main air pollutants in 2010, and estimated the resulting health impacts.

The study focussed on nitrogen dioxide (NO_2) and particles in the size categories 2.5 and 10 microns or less ($PM_{2.5}$ and PM_{10}). It was found that most of the $PM_{2.5}$ at urban background stations is transported over long distances, largely from emission sources outside of Sweden. Road wear resulting from the use of studded tires is the largest source of locally generated PM. The high levels of nitrogen dioxide are caused largely by local traffic emissions, with an increased proportion of diesel vehicles exacerbating the problem.

Exposure to $PM_{2.5}$ was estimated to cause approximately 3,500 premature deaths per year when assuming no division between sources and using an exposure-response coefficient of 6.2 per cent per 10 µg/m^3.

Alternatively, when assuming a division between sources, it was estimated that non-local sources caused just over 3,000 premature deaths per year (exposure-response coefficient 6.2% per 10 µg/m^3), and that residential wood burning caused just over 1,000 premature deaths per year. A higher exposure-response coefficient of 17 per cent per 10 µg/m^3 was used for these primary combustion particles.

In addition, approximately 1,300 annual premature deaths were estimated to be caused by locally generated vehicle exhaust (using NO_2 as an indicator), and another 200 deaths per year from road dust. Particulate matter should, according to the study, probably be added to the impact of local traffic in Sweden.

In summary, the total number of premature deaths was estimated at approximately 5,500 per year when taking into account differences in exposure-response for different PM sources.

For morbidity effects, the study included only a few important and commonly used endpoints, to allow comparisons with other health impact assessments and health cost studies.

The socio-economic costs (welfare losses) related to population exposure to air pollutants as indicated by NO_2 were calculated both with and without a threshold of 5 µg/m^3. Health effects related to annual mean levels of NO_2 in 2010 were valued at between SEK 7 and 25 billion, depending on whether a threshold of 5 µg/m^3 was included or not.

Moreover, welfare losses resulting from exposure to PM pollutants from road dust, residential wood burning and other sources were valued at SEK 35 billion, of which approximately 6.5 billion were linked to productivity losses, i.e. days when people are limited in their normal activities causing a loss of work days. The amount of work and study days lost constituted about 0.3 per cent of the total amount of such days in Sweden in 2010.

Using the division between PM sources and NO_2 (with a 5 µg/m^3 cut-off) as an indicator of traffic combustion, the total annual socio-economic cost was approximately SEK 42 billion.

Christer Ågren

Study: "Quantification of population exposure to NO_2, $PM_{2.5}$ and PM_{10} and estimated health impacts in Sweden 2010" (December 2014). By M. Gustafsson, B. Forsberg, H. Orru, S, Åström, H. Tekie, K. Sjöberg. Swedish Environmental Research Institute IVL Report B 2197. Find the full report on ivl.se under Publications.

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Gasping for air

Air pollution is one of Europe's gravest environmental threats. Every year 400,000 people die prematurely because of poor air quality, but the European Parliament has the power to change that. Members of the European Parliament are now starting to work on a number of EU laws, including the National Emissions Ceilings and Medium Combustion Plants Directives, which could substantially improve the air we breathe.

Twelve factsheets reveal how air pollution affects us, from our health to our economy, and explain what the main sources of pollution are. Crucially, they contain policy recommendations to MEPs that will help clean up our air. Everywhere.

The 10 best climate measures in Northern Europe

A number of national environmental NGOs were asked to describe and rank their ten best climate measures.

There is a great diversity among these measures. Hardly any country seems to have noticed what their neighbours are doing. So all climate policymakers should take a look, not only at the ten winners, but at the full smorgasbord of measures in neighbouring nations.

Carbon Capture and Storage in Norway – The moon landing that failed

The Norwegian interest in CCS depends largely on the oil and gas sector. In the 1990s, oil companies operating in Norway began research and development. In 2005 the government took the lead. Prime minister Jens Stoltenberg announced the building of a full-scale CCS plant at Mongstad outside Bergen in 2006, a project equivalent to the moon landing, in his own words. For a period the per capita investment in CCS research and development was among the highest in the world. In 2013 the project to build a full-scale CCS plant at Mongstad in Norway was ended.

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Coming events

Informal Meeting of EU Environment & Energy Ministers. Riga, Latvia, 14 - 16 April 2015. Information: *http://europa.eu/newsroom/calendar/*

The Air Quality and Emissions Show. Telford, United Kingdom, 22 - 23 April 2015. Information: *http://www.aqeshow.com/*

Health Effects Institute Annual Conference. Philadelphia, USA, 3 - 5 May 2015. Information: *http://www.healtheffects.org/annual.htm*

Fifth Symposium on Ultrafine Particles (UFP-5). Brussels, Belgium, 4 - 5 May 2015. Information: *http://ufp.efca.net*

36th International Vienna Motor Symposium. Vienna, Austria, 7 - 8 May 2015. Information: *www.övk.at/index_en.htm*

IMO Marine Environmental Protection Committee (MEPC). London, UK, 11 - 15 May 2015. Information: *www.imo.org*

23rd European Biomass Conference and Exhibition. Vienna, Austria, 1 - 4 June 2015. Information: *http://conference-biomass.com/*

Green Week 2015: Nature – our health, our wealth. Brussels, Belgium, 3 - 5 June 2015. Information: *www.greenweek2015.eu/*

UNFCCC meeting of subsidiary bodies. Bonn, Germany, 3 - 14 June 2015. Information: *http://unfccc.int/*

EU Environment Council. Brussels, Belgium, 15 June 2015. Information*: http://europa.eu/newsroom/calendar/*

EU Sustainable Energy Week. 15 - 19 June 2015. Information*: www.eusew.eu/index.php*

CLRTAP EMEP Steering Body & Working Group on Effects. Geneva, Switzerland, 14 - 18 September 2015. Information: *www.unece.org/env/lrtap/*

European Photovoltaic Conference and Exhibition (EUPVSEC 2015). Hamburg, Germany, 14 - 18 September 2015. Information: *www.photovoltaic-conference.com*

UNFCCC Conference of the Parties (COP) 21. Paris, France, 21 November - 11 December 2015. Information: *http://unfccc.int/*

CLRTAP Working Group on Strategies and Review. Geneva, Switzerland, 15 - 17 December 2015. Information: *www.unece.org/env/lrtap/*