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In its first report on countries' progress towards EU air pollution goals, the European Commission said that most member states are at risk of missing their binding emission reduction targets.

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Serious health effects and high mortality rate from burning fossil fuels and climate heating

Swedish medical associations have summarised the current scientific evidence on the health effects of climate heating and highlighted important areas where efforts to reduce carbon dioxide emissions, such as phasing out fossil fuels and reducing meat consumption, will also have profound health benefits.

The report is supported by the leading medical organisations in Sweden, as well as three medical institutions in collaboration with AirClim, and highlights the threat of climate heating for Scandinavia, Europe and the world as a whole.

Covid-19 has highlighted fundamental aspects of the way our society is organised and the requirements for handling threats and crises, as well as our shortcomings in doing so, especially when it comes to prevention. Let's learn from this! Climate change poses a much greater threat to our health and has far more serious consequences than the current pandemic. Powerful and rapid action is essential to

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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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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 advocacy 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.

AirClim

Editorial

"Place the most vulnerable at the core of the response to the climate crisis"

The citizens of Small Island Development States (SIDS) are among the most vulnerable people to climate change. More than 60 million people living on these islands are threatened directly by sea-level rise and more intense weather-related natural disasters, caused by global heating. The Alliance of Small Island States (AOSIS) is the intergovernmental organisation of those 39 low-lying coastal and small islands states, 28% of the developing countries. As the existence of many AOSIS states is put at risk by climate change, AOSIS has threatened lawsuits. The results of a review of the literature show that potential liability for climate-change-related losses for the SIDS is over $570 trillion. This September, at the start of the UN General Assembly, AOSIS again issued an urgent call for economic support and climate action to deal with the double financial blow of both the Covid-19 pandemic and ongoing climate impacts. "SIDS are sinking: not just from climate-induced sea level rise, we are sinking in debt. Leadership must place the most vulnerable at the core of the response to the climate crisis", that is the main message of AOSIS, which concludes that such an approach would save all nations from the threats of climate change.

AOSIS is fighting for the 1.5°C target of the Paris Agreement. The CONSTRAIN[1] report from December 2019 zeroes in on the remaining carbon budget for the 1.5°C target as well as projected surface warming rates over the next 20 years. Both topics are crucially important to the implementation of the Paris Agreement. Building on the methodology used in the IPCC Special Report on Global Warming of 1.5°C, the report states that the remaining carbon budget is 395 (235) Gt CO_2 if we are to meet the warming limit of 1.5°C with 50% (66%) probability. Present annual emissions are roughly 40 Gt CO_2 annually. Animations[2] show very clearly how little time is left until we pass the 1.5°C tipping point.

AirClim is currently helping Climate Action Network (CAN), with generous support from the Swedish Postcode Foundation, to develop 1.5°C pathway proposals that show how this tipping point can still be avoided, and to analyse the latest climate science from a CAN point of view.

In the meantime, climate heating is continuing, as summarised for example in the 2019 report of the American Meteorological Society[3]. Covid-19 enforced restrictions will slow global CO_2 emissions in 2020 compared with 2019. But temporary CO_2 emission reductions will not slow down global warming – unless governments decide to intervene and help to make emission reductions permanent[4].

Patience is running out – there are unfortunately forces out there with a very different agenda, who have blocked, ignored or slowed down efforts to change our energy, transport and land-use systems for far too long. These forces need to be held accountable for the severe lack of progress and politicians need to be monitored constantly to discourage them from non-action and voting against environmental improvements. NGOs must no longer be overridden by industry lobbyists, but actively step up and forcefully influence decision-makers through science-based efficient communication.

Reinhold Pape

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4. https://eciu.net/analysis/infographics/covid-19-climate

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avert the worst climate scenarios. It is becoming increasingly clear that the actions of individuals are not enough, yet it still seems that decision-makers are hiding their heads in the sand. Courageous, long-term political decisions and action are needed now to stop climate change in time, and Covid-19 has shown that it is possible!

The greatest immediate threats to our health globally are lack of food and clean water, the effects of which can already be seen in growing numbers of refugees and conflict around the world. Access to drinking water in large parts of Asia is threatened by the continued melting of glaciers in the Himalayas, and in the South American Andes. The effects are very unevenly distributed around the planet, and rising temperatures will hit poor countries the hardest, while the effects in the Nordic region will probably be more limited from a global perspective. Nevertheless, we are already seeing the effects of a warmer climate, with an increased risk of heatwaves and forest fires. So we too have a lot to gain from limiting climate impact as much as possible!

One of the more local effects is heatwaves. A European academy of scientists recently compiled the effects of various future scenarios. If we continue to emit carbon dioxide at the current rate, a sharp increase in heatwaves is expected in Europe, and by the year 2100 it is forecast that about 132,000 people in Europe may die of heat-related causes each year if temperatures continue to rise at the current rate. There are naturally some uncertainties in this figure and it is difficult to put it into perspective, but it can be compared with the mortality figure for Covid-19, which has so far claimed the lives of about 202,000 people in Europe (30 July).

In addition we are already seeing effects on the panorama of disease; viral diseases that did not previously exist in Europe are spreading, and the occurrence of allergies is rising, which now affect around 30 percent of our population.

Seen together, these examples show that the effects on our health are considerable, and could have widespread and financially costly consequences for healthcare, as well as causing enormous suffering. This threat is now being highlighted by Sweden's largest medical organisations – the Swedish Medical Association and the Swedish Association of Senior Hospital Physicians – which are backing a report that summarises the current state of knowledge on the effects of climate change on health (link).

The good news is that if we act now these effects can still largely be prevented.

The key measures for reducing climate impact also contribute to better health, so this is a win-win situation. The air pollutants associated with carbon dioxide emissions into the atmosphere also have very serious health effects. Carbon dioxide is mainly produced by the combustion of fossil fuels (coal, petrol, oil and natural gas). When these fuels are burned they produce particles containing soot, polycyclic aromatic hydrocarbons (PAHs), metals and gases such as nitrogen dioxide, sulphur dioxide and carbon monoxide. All these compounds can have adverse effects on our health, and exposure to them increases the risk of cardiovascular disease and cancer, while recent research also shows impacts on cognitive functions and increased risk of dementia.

Current estimates indicate that the use of fossil fuels globally leads to around 3.6 million premature deaths per year. Again, this can be compared with Covid-19, which to date is estimated to have caused around 670,000 deaths globally (likely to be an underestimate).

Further measures will also be needed to limit climate change. For example, we must reduce our intake of red meat. This will also have benefits for our health.

Taken as a whole, this information shows that, for a large proportion of the population, society has in many ways so far failed to create living conditions that are sustainable and acceptable in the long term. Economic interests have been allowed to rule, but there are opportunities to change our energy and transport systems if only the will exists.

Let this pandemic give us time to think about how important prevention really is. To prevent the worst effects of climate change, we must now redesign our energy and transport systems so that they are sustainable, with the added benefit that we eliminate a large number of deaths that are associated with the burning of fossil fuels.

Anna-Carin Olin

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Link to APC report: https://www.airclim.org/sites/default/files/documents/factsheet-climate-and-health.pdf

Scaling up renewable energy investment in emerging markets

The untapped potential for the renewable energy sector in emerging markets in Africa, Asia and Latin America is enormous, and should be addressed urgently in recovery efforts post-Covid-19.

The transformation of the world's energy system in line with internationally established climate and development objectives will need a significant scaling up of energy investment. Yet renewable energy investments fell by 2.6% in the first quarter of 2020 compared to the same period in 2019[1]. New commitments dropped further during April and May, two-thirds lower than the same period last year. The financial impact of Covid-19 is even greater in emerging markets. Increased risk aversion and a global liquidity crunch generated severe capital outflows from emerging markets[2]. Foreign capital flows to emerging markets are estimated to decrease by 53% during 2020.[3]

In addition, the crisis is likely to be accompanied by a wave of credit downgrades, making it even more challenging for borrowers from emerging markets and developing countries to access the international debt market. With reduced project financing options, emerging markets could see a decrease in new renewable energy projects. There are also concerns that developing countries will prioritise fossil fuels as a means to recover from Covid-19. For example, South-east Asia countries such as Vietnam and Indonesia, which have large coal deposits, may see the exploitation of these resources as a cost-effective option for boosting power generation and the economy.

Fatih Birol, executive director of the International Energy Agency (IEA) stated that "The historic plunge in global energy investment is deeply troubling for many reasons. The slowdown in spending on key clean energy technologies also risks undermining the much-needed transition to more resilient and sustainable energy systems." Finding ways for emerging markets to create an environment for investment in renewable energy is of great importance.

That being said, there are factors that must be addressed to accelerate the development of renewable energy investments in emerging markets, but also ensure they are as sustainable as possible for the affected stakeholders. Risk-mitigation instruments will be essential, especially as the Covid-19 pandemic and its disruptions have made investors more risk averse.

Current trends in renewable energy development are already diversifying the investor base and decreasing funding costs. However, it is of vital importance that the right tools and policies are in place to enable these developments to effectively combine international and national goals with local implementation. The International Renewable Energy Agency (IRENA) Coalition for Action has published a report which summarises the challenges, risks and solutions for scaling up renewable energy investments in emerging markets. The report highlights these factors in three main categories: Finance and Bankability Challenges, Administrative and Capacity Challenges and Policy and Regulatory Challenges.

Finance and Bankability Challenges

Renewable energy projects need to be seen as profitable and executed as proposed over the financing period. The risks must be minimised in every way possible. Off-taker risk parties, i.e. investor-owned, municipal or national utilities that buy electricity from independent power producers, may not have a balance sheet strong enough to satisfy investors.

A tool to mitigate this risk is an off-taker guarantee mechanism. If the off-taker is not creditworthy, a state guarantee can be used to mitigate the payment risk, and in some cases the regulatory risk, to make the contract bankable enough to be accepted by lenders and investors. In addition, if the state does not have a high enough credit rating, development banks or export credit agencies can step in and and provide the guarantees.

One successful example of this is the 25.5 MW Cabeólica wind farm project, the first commercial-scale wind farm in sub-Saharan Africa. It was commissioned in 2011 and developed by the private company InfraCo Africa with support from the government of Cabo Verde and its national utility, Electra. Electra had no credit rating and was loss-making at the time of signing the power purchase agreement (PPA). The PPA defines all the commercial terms for the sale between the two parties and defines the revenue and creditworthiness of a project. The off-taker guarantee mechanism was essential to develop the project. The government of Cabo Verde endorsed the Cabeólica wind farm by establishing a public-private partnership and issuing a government support agreement.[4]

Administrative and Capacity Challenges

Factors connected to administrative challenges and capacity, such as the project development's timeliness and the transparency of the procedures and decision-making processes, are essential for a desirable investment environment. Land access is one of the most problematic concerns when it comes to renewable energy projects in emerging markets.

The renewable energy industry should not be put in a position of attempting to resolve old land disputes. The lack of jurisdictional guidance in these cases can create a terminal challenge for the project's development. One risk mitigation measure is to centralise, strengthen and streamline administrative and permitting institutions. This could encourage investment as a concentrated framework to improve the coordination and permitting requirements processes.

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An example of this is Zambia's Public Private Partnership Unit[5].

Another important factor is the mitigation of land tenure issues. In many nations, land use and ownership records are incomplete, and arrangements of land ownership are complex, such as post-colonial structures and unresolved indigenous land claims. The departments handling land reform and planning are often distant from energy policy departments. In such cases, introducing some level of government guarantee in the event of land disputes, or the definition by government of zones appropriate for renewable energy development, could have a tremendously positive impact on renewable energy development.

When it comes to the social acceptance of renewables and land tenure issues, proactive engagement and dialogue with landowners and communities is vital. In Mexico, following years of land disputes, the promoting of good relationships with stakeholders is a high priority for renewable energy developers. In the Oaxaca region, an annual socio-economic community study has been executed and the interests of the population and their views on the performance of the developers in environmental protection, business ethics and local economic development have been documented. This provides a guideline to reinforce the developer's Social Management Plan and to address the risks and opportunities that arise.

Policy and Regulatory Challenges

The main regulatory risk for renewable energy investments in emerging markets is connected to unexpected changes in energy policies, procedures, market design, grid access and resource planning during the project development and plant operations phase. Rules for accessing grid connections, resource planning, curtailment compensation and payment mechanisms can generate regulatory issues.

To address regulatory challenges, an effective legal framework that forms long-term and comprehensive renewable energy policy is essential. A balance between predictability and flexibility is also crucial to adjust to a fast-evolving market environment and technology development. Three main principles should guide the strategies and policy implementations: environmental sustainability, security of supply and economic affordability.

Risk connected to policy exists in both mature and emerging markets. To mitigate policy risk it is important to establish and maintain clear policies and only gradually make changes when necessary, and to announce all changes early and concisely to keep stakeholders informed. This creates confidence in the market through a clear track record, instead of making "retroactive changes", as has happened recently in some markets. In addition, international policy standards and comparability are crucial to deliver political and economic stability. International collaborations contribute to limiting the risk perception, which can be an obstacle to investment potential.

Emilia Samuelsson

Based on:

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The economic recovery during and after the Corona pandemic is an opportunity for decarbonisation

Some of the best measures for the climate, as suggested by NGOs in a poll for AirClim, are good for restarting the economy too.

By mid-2020 many countries are going through the worst economic contraction since the 1930s. Some economists believe it will be essentially V-shaped: first a steep fall, then a steep return to normal. Others believe a large number of businesses and some industries are broken and can't be fixed.

The more persistent the pandemic, and the longer we have to wait for a vaccine that can restore us to relative normality, the bigger the risk of a 1930s-style long and deep depression. The 1929 Wall Street Crash led to Hitler and the Second World War. It did not end until about 1944 (in the US), when the economy geared up to full capacity due to strong demand led by arms production.

The much smaller 2008 recession did not lead to a major war, but it did again lead to a wave of right-wing nationalism.

Whether through wisdom or just for short term self-preservation, most governments on Earth are now handing out unprecedented amounts of money. They hope that they will save businesses with growth potential, and not to hopeless cases. It is a difficult task.

Will cruise ship tourism, commuting to work, eating out or even hair-cutting return to 2019 levels in 2021? 2025? Ever?

Should it return, all of it? The longer the crisis lasts, the more people, including Ministers for Finance, will ask that question.

"Helicopter money" spread out immediately and at random is better than doing nothing, if the alternative is waiting for demand to shrink and deflation to freeze the economy.

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Traditional anti-recession politics is to put money into loss-making businesses to save jobs and into all kinds of "infrastructure", especially roads, or other construction work so as to create jobs.

But some expenses are more sustainable than others, financially and ecologically – especially with a slightly longer perspective.

In May, the EU Commission proposed an updated EU budget for 2021–2027 of €1100 billion and a dedicated EU recovery budget for 2021–2024 of €750 billion, which was later agreed upon. It claims to be green, but according to an analysis from Agora Energiewende, "the few budget elements that specifically address needed investment in the buildings, transport, power and industry sectors total only 80 billion euros", which is clearly not anywhere near enough to put Europe on course for 1.5 degrees.

This 80 billion is not all, however, as member states have stimulus packages of their own. Neither is 80 billion the last word. It may become much more.

A closer analysis of the EU budget and package will have to wait, so here is just some general background on stimulus packages.

Support for cruise ships will save jobs and sustain purchasing power, but if there is not much market for cramming thousands of 70 year-olds on such journeys, it is a dead loss.

Investment in solar power creates jobs immediately. People employed there will spend their wages and turn vicious circles in the economy into virtuous circles. But it also will produce electricity for perhaps 30 years at low cost, and help to reduce carbon emissions, also at very low cost. The same goes for wind power, energy efficiency in buildings, and heat pumps.

As Jigar Shah, a renowned US clean energy entrepreneur and author put it:

"It's critical for us to recognize that we are being looked to by everyone from prominent political campaigns to elected officials in your town to provide the necessary economic development to get us out of Covid."

Some of the best climate measures are also good for economic recovery. AirClim polled NGOs in the Nordic and Baltic countries, as well as Germany, Poland and Russia, to find out what they see as the most promising climate measures. This resulted in a list of 150 measures[1], from which a Top 10 list was created. Acid News tried to show in the "update" of the Top 10 in late 2019 that the proposed measures can be a very valuable tool for use in the National Determined Contributions (NDCs) to the Paris Agreement.

Several of these can also be put to good use not only to reduce emissions but also to create jobs immediately, stimulate the economy generally and to save money compared to other economic stimuli, now that politicians are ready to spend enormous amounts of cash.

How do those measures look now, when seen through a Covid recovery lens? Here is an attempt.

1. Taxing carbon

Carbon taxes are good for the transition from fossil fuels. They have no direct added value for recovery. Some jobs are lost in the fossil industries, but other jobs are gained in renewables and efficiency (see below), which may be more labour-intensive.

2. Support for renewable electricity

Definitely a win-win-win for the climate, immediate jobs and long-term payback. Denmark's wind energy sector employs 33,000 people, many more than used to work in coal power.

3. Improved efficiency of buildings

Same as renewable electricity. A recent US study[2] showed that USD 83.5 billion invested in efficiency measures could save USD 123 billion in fuel costs, create 660,000 jobs in 2020–2023, twice as many job-years over the whole investment, while reducing CO_2 emissions by 906 million tonnes. In a zero-interest world, this

means an effective stimulus, and emission reductions at no cost.

4. Other efficiency improvements (e.g. EU labelling of fridges)

A nation that requires more efficient appliances will produce and export more of such appliances to other countries.

5. District heating efficiency

Improvements in district heating save money, improve air quality and create jobs. The scope is not enormous, but district heating should be well maintained where it exists. There should also be a market for district cooling, which has some advantages over individual cooling, such as better efficiency and less noise. District heating and cooling can both be used to absorb surplus electricity, and make way for a larger share of wind and solar.

If plans for new district heating or cooling already exist, they should be sped up. If such plans do not exist, the lead time may be too long to be of use for recovery.

6. Vehicle emission standards

For the near future, EU standards probably have the main short-term effect of promoting electric vehicles. Electric-only vehicles do not create many jobs, and meanwhile a lot of jobs are lost in the production of internal combustion vehicles. But to save the European car industry as a whole, the transformation cannot be postponed, as even more jobs would be lost then. Most car manufacturers have been extremely slow on the uptake. Giving in to them will not help the industry. Although it would help the oil industry, for no good reason.

7. Other measures to reduce traffic CO_2 (taxes for vehicles and fuels)

As above. To save the automotive industry it will take a loud and clear message to make manufacturers understand what needs to be done.

Some measures will lead to earlier scrapping of gas guzzlers, which creates some new jobs, as does the installation of charging stations and hydrogen pumps.

Improving the recycling of products and materials can create a lot of new jobs.

8. Infrastructure planning

One high priority should be the building of new power lines and planning for them, especially to accelerate already existing plans. The same goes for railways. More long-term projects also create immediate jobs, e.g. for engineers and architects who can also be hit hard by an economic downturn.

Some infrastructure changes can be made quickly, as seen in Brussels and Paris during spring 2020, when many street lanes were converted for bicycles.

In view of recent development, many plans for highways, airports and harbours should be reviewed, as it looks unlikely that air travel, for example, will return to 2019 levels. Obviously not building an unnecessary airport terminal means fewer jobs than building it, but if the money is used on softer structures such as schools, more jobs are created.

9. Waste and recycling

Reducing and reusing waste is usually labour-intensive, so it ticks all the boxes.

10. Land use (afforestation, better agricultural practices, wetland reclamation)

Another a win-win-win. Land use management can create jobs in reforestation, gardening, ecological agriculture, and benefit biodiversity. Some of the jobs are highly qualified, but many can be performed by people on the margin of the labour market, with little training, immediately.

Much has happened since 2013, even before the Covid crisis, and a few other measures were added in the article of late 2019.

11. Emissions trade – working at last!

The ETS creates no jobs as such, but exactly like a CO_2 tax, it is transformative, saves money and probably creates more jobs than it destroys in the short term and definitely so in the medium and long terms. At least during the first several months of the Covid crisis, ETS prices have stayed in the €25–30 region, and if they were to drop much, the EU would not, and should not, accept that.

12. Climate laws and stricter targets

Much like the ETS and carbon taxes, they create no jobs, but add credibility to clean energy investment, which does create jobs.

13. Hydrogen

After many false starts over several decades, hydrogen has moved up the agenda in several countries at the same time, and is increasingly seen as a necessary part of decarbonisation, as a buffer for increasing wind and solar. Construction of electrolysers, storage and pipelines creates direct and indirect jobs, some of them soon.

14. HFC phase-out

The phase-out of climate-hostile refrigerants is a very cost-effective climate measure. It also creates jobs in a rather bumpy sector which needs to grow for the longer term. The people that either replace the refrigerant or install the new cooling devices are the same people that install heat pumps. An accelerated phase-out should save energy and money, because newer cooling equipment uses less electricity.

15. Electric food (and other innovations)

Most of the methods for saving the climate, saving money and creating jobs are well known. We should not primarily be looking for "breakthrough" technology, but some new ideas should be supported, as in the case of producing protein food or fodder from atmospheric nitrogen, water and CO_2. Some of them will work, some not. This will not lift us out of the corona recession, but it will create some jobs for a relatively modest amount of money.

Whether electric food will work or not, innovative approaches are needed for the global food industry, which is very unsustainable.

The above is a sketch of a future AirClim project. NGOs in the same 11 Northern European countries will be asked again to name the best 10 climate measures in their countries, with a view to further assessing their effectiveness in averting a slump, raising ambitions in NDCs and creating jobs in the green recovery.

Fredrik Lundberg

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Making Europe's energy supply compatible with the Paris Agreement

New civil society scenario shows pathway towards 65% emission reductions by 2030

The European Commission will propose in the coming weeks an updated EU 2030 climate target. European NGOs have developed their own Paris Agreement Compatible (PAC) energy scenario that illustrates how EU greenhouse gas emissions can be cut by 65% by 2030.

The EU is lagging behind. Its old 2030 target of cutting emissions by 40% dates back from the time before the Paris Agreement. Such a slow pace obviously is not sufficient to limit global temperature rise to 1.5°C. The United Nations Emission Gap report clearly states that the EU needs to cut its emissions by 7.6% every year between now and 2030 to ensure the 1.5°C temperature target is still attainable. Based on science and on the equity principle, it's high time for the EU to take its responsibility.

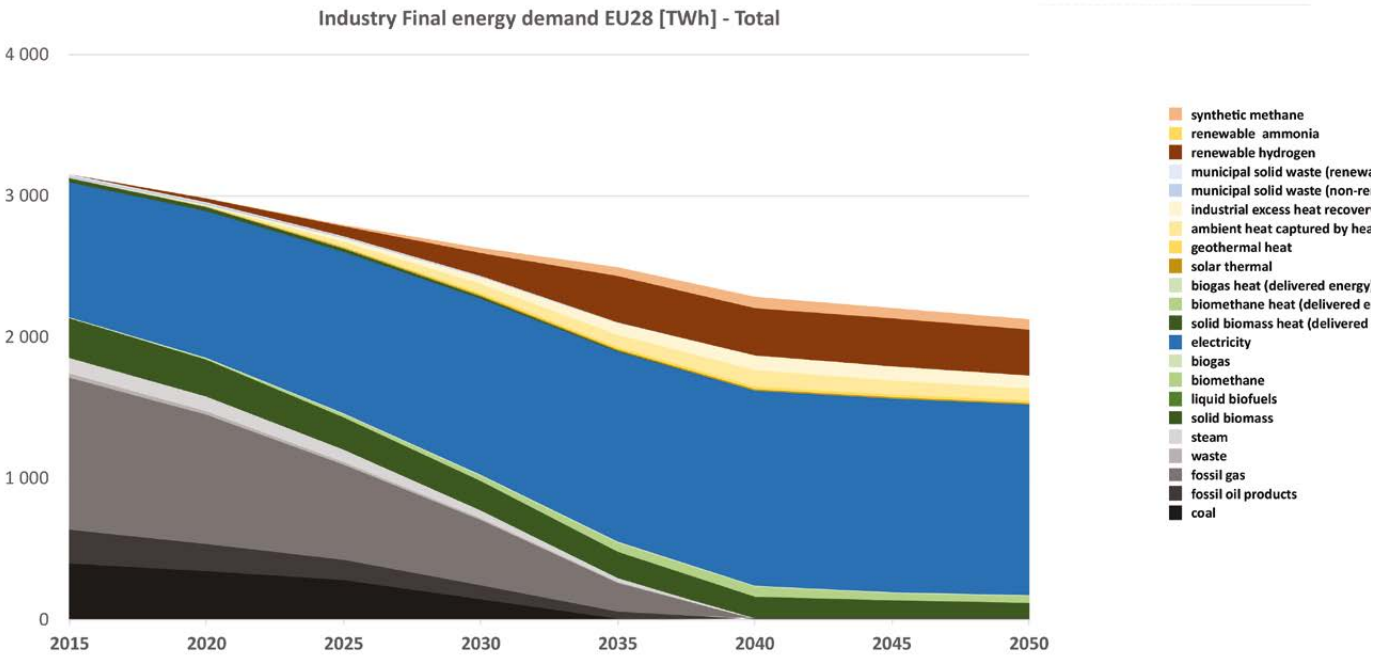
How to get the EU back on track?

European NGOs have elaborated a detailed emission reduction pathway, their energy PAC scenario. It shows how industry, buildings and transport can reach 65% emission reductions by 2030 to achieve net zero emissions by 2040 in a fully renewable energy system. The grassroots approach in scenario building makes the PAC scenario the first of its kind. It is backed by Climate Action Network (CAN) Europe and the European Environmental Bureau (EEB) membership, representing several hundred European NGOs such as AirClim, with altogether more than 47 million individual members.

Based on proven solutions

The PAC scenario follows a rather conservative approach: In its calculations, it refers almost exclusively to mature technologies that are already available and introduced into markets. The message is that 65% emission reductions and 100% renewables are absolutely feasible and that we can start the transition right now.

"We are not the first or the only ones," states Wendel Trio, director of CAN Europe. The PAC scenario actually took over data and findings from a number of reference studies, such as the Finnish LUT University's 100% renewable energy model for

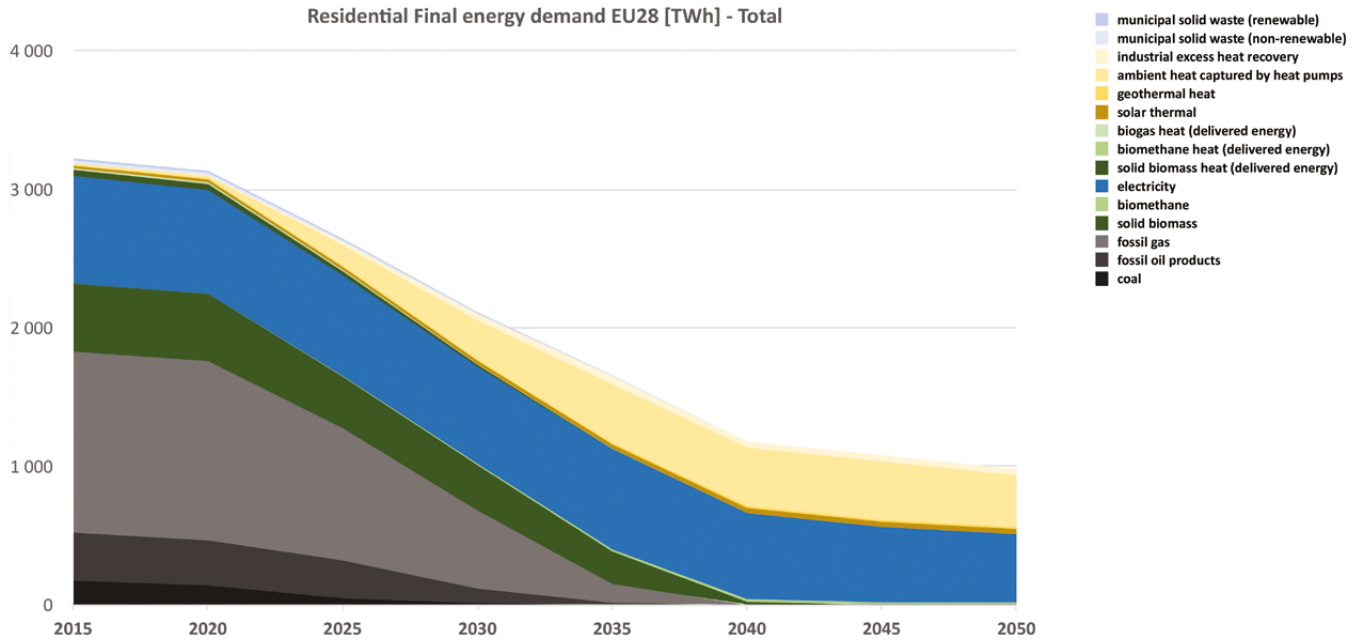


Europe (see Acid News no. 2, May 2020). The key assumptions were developed over one and a half years of interactive scenario building with more than 150 members and academia. This allowed consistent integration of the different policy demands of NGOs, including boundaries such as the protection of biodiversity or sustainability of raw materials supply.

Circular economy in the industry

Let us take a closer look at how Europe's energy landscape evolves according to the PAC scenario findings. We start with the industry sector. This energy-intensive sector is often considered as being difficult to decarbonise. The PAC scenario however describes the manifold emissions reduction potential related to a circular economy:

- Implementing the principles of **reduce,**



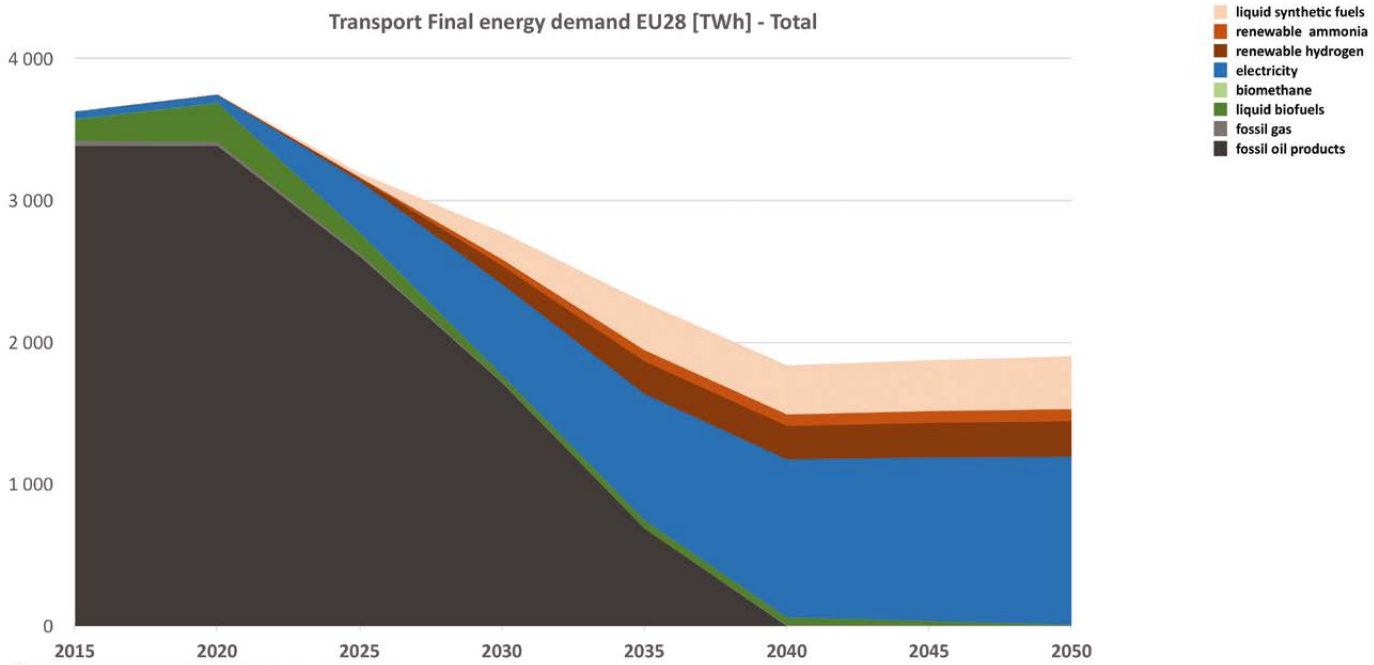
reuse and recycle in industrial value chains makes products less resource-intensive and thus less energy-intensive. For instance, plastics will become highly circular materials, cutting the raw material demand and energy demand of the chemicals industry. Key findings were taken from the circular economy scenario of the Material Economics report and a number of branch-specific assessments.

- By electrifying production processes, in particular in the steel industry, renewable electricity replaces fossil fuels (see for example Acid News no. 2, May 2020: "CCS is not needed"). Those production processes that require high temperatures are covered by renewable hydrogen or sustainably sourced biomethane.

The double opportunity of deep renovation of buildings

The key trend for the buildings we are living and working in is the deep renovation wave. The energy demand of the residential and tertiary sectors are reduced by almost two-thirds between 2015 and 2050.

- While currently only 1% of the existing building stock in the EU are **renovated every year, this renovation rate increases to 3%**. Most of this refurbishment is a deep renovation that reduces buildings' energy demand by 60%, for instance by improving the insulation, based on research from the EUCalc project.
- This deep renovation wave not only cuts energy demand. At the same time it is an opportunity to **exchange inefficient individual fossil fuel boilers** with electric heat pumps that run on renewable electricity, or to connect the building to a district heating network that distributes renewable heat such as geothermal heat, ambient heat or solar thermal heat.
- Behavioural changes with regards to the adaptation of digitalisation and home automation can contribute to energy savings, but also bear potential rebound effects. The PAC scenario assumes that **technology changes and**



behavioural changes are important, but do not need to be mobilised to their full extent. The PAC scenario is partly based on findings from a Fraunhofer ISI study commissioned by the Coalition for Energy Savings.

Efficient and electrified transport

For a long time, mobility has been a source of increasing energy demand and greenhouse gas emissions. It's the sector that currently is the most dependent on fossil fuels. In the PAC scenario, efficiency and electrification are the key trends to enable the transport sector to switch to 100% renewables by 2040, while cutting in half its energy demand.

- Firstly, our mobility behaviour changes with a **stronger modal shift** from cars to public transport, cycling and walking. Goods are increasingly transported by rail freight.
- Remaining cars on the road will all be electrified by 2040 so that they can **charge using renewable electricity**. The PAC scenario adapts most of the trajectories described in Transport & Environment's pathways for decarbonising the EU fleet of cars, buses, trucks, planes and ships. Efficiency gains of vehicles will more than offset the slight increase in transport activity.
- **Renewable hydrogen** covers those transport sectors that are difficult to electrify, namely shipping with ammonia and aviation with liquid synthetic fuels, both derived from renewable hydrogen.

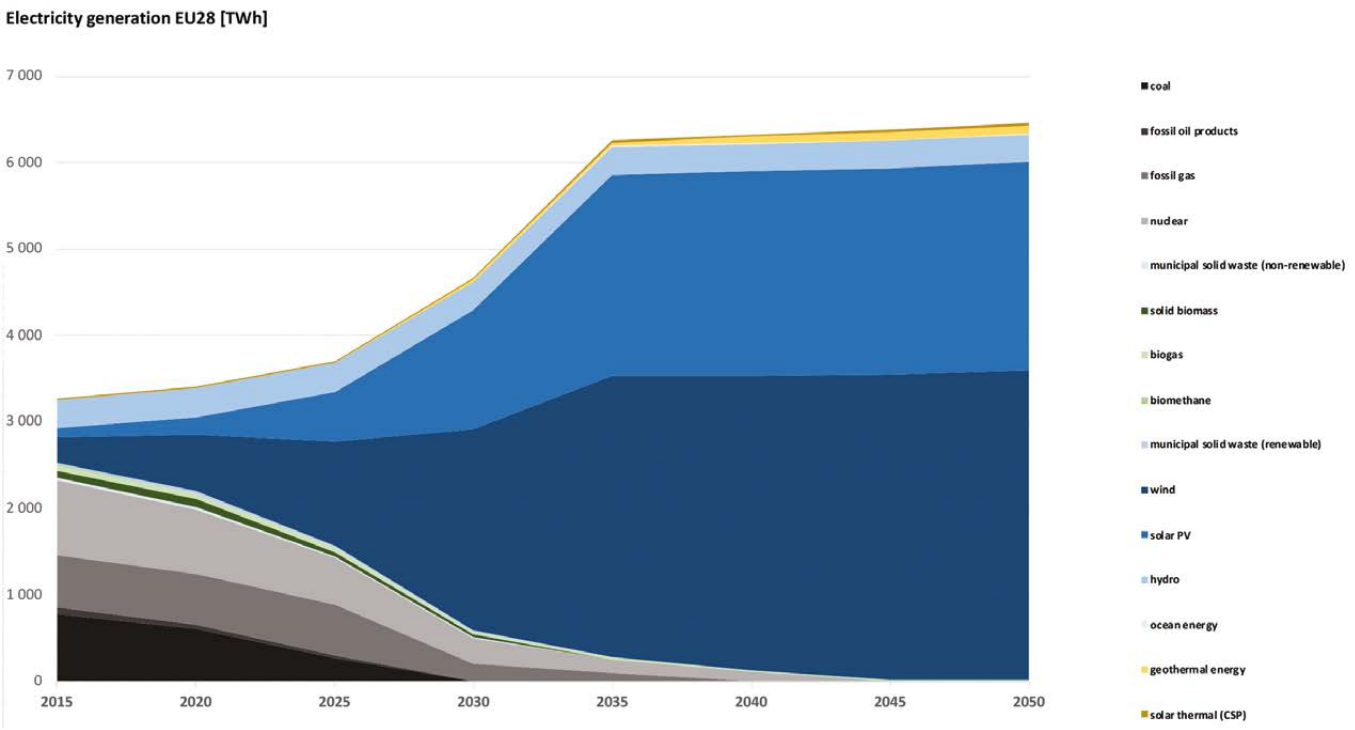
Phase out fossils and nuclear, increase renewable electricity

In all sectors, renewable electricity takes a central role in phasing out coal by 2030, fossil gas by 2035, followed by fossil oil products. Nuclear largely disappears from the mix by 2040. Electrified industrial processes, electric heat pumps, electric vehicles and electrolysers for hydrogen production altogether double the electricity demand between 2015 and 2050. Solar photovoltaics and wind energy will primarily replace fossil fuels and cover the additional demand. They are already the cheapest sources of electricity, with only limited shares of their total potentials being mobilised so far. By 2030, electricity generation from onshore and offshore wind increases roughly fourfold, while solar electricity multiplies sevenfold.

Flexibility options, the jokers in a 100% renewable system

Will an energy system still be stable if it relies largely on solar and wind power that depend on the weather? The European electricity market modelling carried out by Oeko Institute with the PAC scenario data confirmed that the lights will stay on around the clock. Whenever the sun does not shine or the wind does not blow, a number of flexibility options can fill in the gap: dispatchable renewable energy sources such as hydropower and biogas can ramp up their production when needed. Storage technologies such as pumped hydro and batteries can reinject the electricity stored during stormy and sunny periods. Electrolysers harvest the renewable excess electricity to produce hydrogen.

On the consumer side, industries will increasingly shift their demand to those times when there's an oversupply of cheap renewables. Well-connected electricity grids, gas grids and heating networks are the base for such a smart interplay. This is not science fiction. Many European regions have already gained experience in providing a stable 100% renewable



electricity supply at different times of the year.

Join the PAC scenario building

The PAC scenario gives an aggregated EU-wide overview. How does it translate into country-specific emission reduction pathways? Over the following months, CAN Europe will explore this question together with modellers from Climate Analytics, and with AirClim and other members under the 1.5°C pathways project. As the PAC scenario remains a learning document, CAN Europe is looking forward to welcoming members and other stakeholders who want to contribute to this civil society-led scenario building.

Jörg Mülenhoff

Feel free to download the technical summary of the PAC scenario or reach out to Jörg Mühlenhoff, Energy Scenarios Policy Coordinator at CAN Europe.

National dietary guidelines could reduce greenhouse gas emissions

Official UK dietary advice, known as the Eatwell Guide, could reduce the risk of premature death by an estimated 7% and contribute to a significant reduction in greenhouse gas emissions – if it is followed. A study based on observational data from the UK's National Diet and Nutrition Survey found that those who adhere to five or more of the nine dietary guidelines could reduce their risk of premature death by an estimated 7% and at the same time decrease their carbon dioxide emissions from food consumption by 30%. Increased consumption of fruit and vegetables proved to be the single most important dietary change to decrease the risk of premature mortality, while reduced meat consumption was one of the most important factors concerning greenhouse gas emissions. However, most people in the UK do not stick to these guidelines. The study shows that only 0.1% of the UK population are able to comply with the national dietary guidelines and 30.6% adhere to at least five of them. And even if all guidelines were followed, it would not be sufficient to achieve the objectives of the Paris Agreement. More transformative dietary changes are needed.

These finding are confirmed by a recent study, published by EAT, that investigated current patterns of food consumption and analysed the efficiency of national dietary guidelines in G20 countries in relation to human health and environmental sustainability. The research found that most of the national dietary guidelines (NDGs) are not ambitious enough to reach the goal of limiting global warming to 1.5°C. Only a few G20 countries include environmental impacts in their NDGs and adherence to the guidelines is very low throughout these countries. Only China and Indonesia have current consumptions patterns in line with what is needed to protect the health of people and planet, according to the study. Making sustainable and healthy food choices is one of the single most powerful actions an individual can take to fight climate change. The G20 countries have an opportunity to influence these choices by raising the level of ambition in their NDGs.

The report "Health impacts and environmental footprints of diets that meet the Eatwell Guide recommendations: analyses of multiple UK studies": https://bmjopen.bmj.com/content/10/8/e037554

The report "Diets for a better future": https://eatforum.org/knowledge/diets-for-a-better-future/

Oil or Paris

The stakes are high for the Swedish government when it decides whether to permit a big residue oil refinery in Lysekil. If it says yes, Sweden is unlikely to reach its climate target. If it says no it is a setback for oil-exporting countries, especially Norway and Saudi Arabia.

Much is at stake when the Swedish government decides whether to grant a permit for the residue oil conversion complex (ROCC), an expansion of the Saudi-owned Preem refinery in Lysekil in West Sweden. It would increase the CO2 emissions with one million tons per year from about 1.6 Mton to 2.6 Mtons per year for decades ahead. It would make the Lysekil refinery the top emitter in Sweden.

The Environmental Court gave the green light for the ROCC in 2018, and the higher court agreed in June 2020. They said that the courts cannot interfere with emissions inside the EU European Trading System (ETS).

The final decision will be taken by the government, in an unusual procedure[1].

The case is a test for the Swedish Climate Law of 2017, which stipulates that emissions be reduced to at most 10.7 Mt of greenhouse gases by 2045, or 85 percent less than the 1990 baseline. This will be hard to achieve if some 2.6 million tons are ringfenced, along with other companies in Sweden within the ETS. Together they emitted 18.8 Mt in 2019, none of which is to be touched by national policy if the courts got it right.

The Emission Trade Directive 2003/87 does indeed rule out the setting of conditions or limit values on operations participating in the ETS. The courts' interpretation that the ETS is the "one ring to rule them all" is nevertheless controversial.

All member states, and the European Union itself, have implemented a large number of policies that have interfered with the ETS. Policies for renewable power and efficient use of electricity and heat have pushed CO_2 prices down, sometimes to a level much below expectations.

The Swedish Climate Law was not unique. The UK legislated on a Climate Law in 2008, requiring the government to cut emissions by 80 per cent between 1990 and 2050, in 5-year steps. It was created by a Labour government but the Conservatives, in coalitions or alone, have stuck to it so far.

The UK found the ETS so wanting that it set a floor price[2] from 2013, increasing each year, that was much higher than the ETS price. The EU did not stop the UK. Instead it followed suit a few years later, and raised the price for the whole of Europe, in a series of complicated moves that were clearly against the original 2003 principles, by bending and twisting the system.

The reason why the UK did so, followed by the rest of the EU, was of course that the ETS did not deliver greenhouse gas reductions on a meaningful scale for most of the period from 2005 to 2017.

Sweden was not first, nor is it last. Germany has bypassed the ETS with climate goals of its own, and with the decision to phase out coal and lignite by 2038. This has been criticised as too little and too late, but it is not dependent on the ETS.

France has legislated on climate neutrality by 2050.

In the Netherlands, the government was even forced by a court to act against emissions within the ETS. Greenhouse gas emissions in the Netherlands must be reduced by 25 percent (compared to 1990 levels) by the end of 2020. This was ruled by The Hague District Court in 2015 in the case of the Urgenda Foundation against the Dutch State, later confirmed by higher courts.

The Swedish courts' view is that the 2003 Directive is a fixed framework with an untouchable inner logic. Most politicians in Europe on the other hand see the ETS as a work in progress. If it works, it works. If not, try something else. The authors of the directive could hardly have foreseen the possibility that they would create a wall of protection for climate offenders against their governments. Even if they did, this is not what the Council and Parliament ask for now, and not necessarily what the EU Court will say. There are tensions and cracks in the climate legal structure.

So Preem is a test case for all of Europe, one of many, for the original ETS against other climate laws and targets.

It will also be closely watched by oil and gas exporting countries, especially Norway, Saudi Arabia and Russia.

Norway is just 100 km away from Preem Lysekil. Hydrogen and some of the oil for the refinery come from Norway. Norway intends to extract oil and gas for many years. A new oil field was inaugurated in January 2020.

CCS is an existential issue for Norway's oil and gas; there is no other way to lay claim to being a climate leader while also keeping the oil and gas flowing. Now that

CCS for power stations looks less and less credible, the Norwegian-led CCS lobby is pushing more and more new applications, such as bio-CCS and CCS for emissions from heavy industry. The latest thing is "blue hydrogen" produced from natural gas with CCS, which hardly exists yet and must prove its value compared with "green hydrogen" from water electrolysis and renewable power.

Norway funds CCS research and an ongoing pilot project at Preem Lysekil with money from government-owned or controlled entities such as Equinor, Gassnova, CLIMIT and Sintef [3,4]. Norwegian lobbyists are all over the place in Sweden, and managed to push "negative emissions" as a major plank for the Centre Party and one of the 73 points of agreement for the parliamentary majority behind the Labour/Green government in January 2019. Before that, there was hardly any discussion about CCS in Sweden, which has no gas, oil or coal.

Preem's ROCC project, and especially the plan to store 0.5 million tons of CO_2 per year from a hydrogen factory, fit into the Norwegian blueprint in several ways. It intends to use Norwegian gas as LNG. The CO_2 will be transported by Norwegian ships to Norwegian storage, making Preem one of the few prospective foreign "customers" for CO_2 storage. Preem could open the door for other Swedish customers, such as a cement factory and a Fortum waste power plant in Stockholm – with much of the cost covered by the Swedish government.

Norway has sided with some of the worst emitters and climate obstructionists for many years. It is a member of the Umbrella Group, along with the United States, Canada, Russia, Japan and Australia[5], instead of aligning with the EU. This paid off well in Kyoto 1997, when Norway was awarded an increase of emissions between 1990 and 2010. Its actual CO_2 emissions also increased 16 percent[6] between 1990 and 2019. Other GHGs have fallen, but outside the core of the oil and gas industry. A target has been set to cut emissions in the future, but the fine print says offsets.

Norway has never tried to deny the climate challenge. But it acts to protect its own interests, which means delaying action, and keeping the gas and oil flowing as long as possible. It has usually supported all kinds of "somewhere else" research and policies in the name of cost-effective climate action.

The Saudi connection is more straightforward. Preem is owned by the Saudi citizen Mohammed al-Amoudi.

Al-Amoudi is worth about 9 billion US dollars, according to Bloomberg. High-level business in Saudi Arabia is never far from politics, as Al-Amoudi found out in late 2017 when he was held captive for 14 months along with other billionaires (in a luxury hotel) in an "anti-corruption campaign". They were released after paying up a total of 107 billion dollars, according to Al Arabiya.

Saudi Arabia recently sought to re-

move the term "fossil fuel subsidies" from expert briefings ahead of the G20 summit[7], under Saudi presidency. The G20 took a stand against such subsidies in 2009 and this has been reaffirmed every year since.

Saudi Arabia is the 2020 chair for the G20, an organisation for rich and/or powerful governments, attended by the world leaders in person at the annual summits. The totalitarian ruler Crown Prince Mohammed bin Salman bin Abdulaziz al-Saud, known as MBS, will host the next summit in Riyadh in November.

Saudi Arabia is in its own words "not only a key player in the region, it plays an important role in stabilising the global economy". It played an active part in overthrowing the elected Morsi government in Egypt in 2013. It has financed many of the fiercest jihadists in Syria and Iraq, and waged a war on Yemen, leaving 100,000 dead and now the worst humanitarian catastrophe on Earth. According to the CIA, MBS personally ordered the killing of the journalist Jamal Khashoggi. Saudi Arabia financed Pakistan's atomic bomb, and may have plans for a bomb of its own, judging by the long-range missiles acquired from China.

But never mind that. Everyone will be there – Covid-19 permitting – ready to smile at the concluding photo-op in Riyadh on 22 November: Xi, Putin, Trump, Macron, Trudeau, Abe, Johnson, Bolsonaro, Merkel, Modi, Ramaphosa, Erdogan, von der Leyen to name a few. Nobody ever declines an invitation from MBS.

Since 1992, Saudi climate negotiators have consistently undermined negotiations in the UN climate convention with rudeness and endless technicalities. In preparation for the Riyadh G20 summit, a softer (perhaps more Norwegian) rhetoric will be tested. Its headlines include "Empowering people" ("Create conditions under which all people especially women and youth can work and thrive" indeed!), "Safeguarding the Planet" and "Shaping New Frontiers"[8].

A new concept, created for the occasion is "Circular Carbon Economy":

"Under the Saudi Presidency, the G20 will discuss the concept of a circular carbon economy, covering a variety of energy solutions and technologies, underpinned by research, development and innovation (RD&I) to ensure cleaner, more sustainable and affordable energy systems."

Cleaner Energy Systems include[9]:

- Nuclear power
- CCU / E2V
- CCS
- Direct Air Capture

The circular carbon economy is thus likely to involve continued combustion of fossil fuels either with CCS or with CO_2 emitted and then recaptured from the air with gigantic vacuum cleaners.

With something close to a world record in greenwashing, the Saudi G20 circular carbon economy is symbolised by four Rs, standing for reduce, reuse, recycle and remove. (Déja-vu, yes! The waste hierarchy.)

Reduce is to be achieved through nuclear power, efficiency and renewables.
Reuse means "convert carbon into another useful industrial feedstock" including E2V, which is decoded as "emissions to value".
Recycle includes bioenergy (probably because it can take up some of the fossil CO_2) and hydrogen.
Remove is CCS and Direct Air Capture.

Preem's plans check several boxes here. Al-Amoudi has also personally "promoted enhanced oil recovery for many years. In 2008, the sheikh funded King Saud University's Sheikh Mohammed Bin Hussein Al Amoudi Enhanced Oil Recovery (EOR) Research Chair which has established itself as an invaluable resource of knowledge and research for the Saudi petroleum industry", according to that university[10]. Preem withdrew its application on 28 September 2020, citing changing economic conditions. According to the daily Dagens Nyheter, the decision was triggered by a decision by the tax authority to refuse a respite for payment of large amounts of tax.

Fredrik Lundberg

1. www.airclim.org/acidnews/swedish-refinery-crossroads-2x-fossil-future-contested

2. https://ember-climate.org/wp-content/uploads/2016/11/Sandbag_Carbon_Floor_Price_2013_final.pdf

3. https://news.cision.com/se/preem-ab/r/preem-gor-forstudie-om-koldioxidinfangning,c2455927

4. https://www.preem.se/om-preem/hallbarhet/ccs/

5. https://www.europarl.europa.eu/thinktank/en/document.html?reference=IPOL_STU(2019)642344

6. Source BP statistics June 2020

7. www.climatechangenews.com/2020/07/14/saudi-arabia-censors-fossil-fuel-subsidy-discussion-g20-host/

8. https://g20.org/en/Pages/home.aspx

9. https://www.ief.org/_resources/files/events/4th-ief-eu-energy-day-the-green-new-deal-and-circular-economy/02.-khalid-abuleif.pdf Abuleif is Saudi energy minister and top climate negotiator.

10. https://news.ksu.edu.sa/en/node/102121

EU Commission proposes strategy for energy system integration

The European Commission issued its strategy – "Powering a climate-neutral economy: An EU Strategy for Energy System Integration" – on 8 July 2020. This is one of several policy initiatives which have been presented as a part of the European Green Deal.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Why is the strategy important?

At present the energy system has a rigid structure. It is built on parallel and vertical energy value chains. In other words, specific sources of energy are linked to specific end uses. The EU Commission has concluded that this system is too technically and economically inefficient to deliver a climate-neutral economy. The outcome is significant losses such as waste heat and low energy efficiency.

The EU Energy System Integration Strategy sets out a vision of how to accelerate the transition from inefficiently structured energy value chains to a system that can deliver low-carbon, reliable and resource-efficient services at lowest possible costs.

EU climate chief Frans Timmerman stated, as he presented the strategy, that today's system is "way too wasteful and way too rigid to be fit for a sustainable future" and that "we need to complete an overhaul of the current energy system which is quickly becoming a relic of the past".

It is crucial to address these shortcomings in order to reach climate neutrality by 2050. By planning and operating the EU's energy system in a holistic way the strategy enables the combination of decarbonised and renewable energy supply with efficient demand-side technologies.

Timmerman stated that "we need to stop transferring the wrong energy carriers in the wrong way to end-users". Through using the relative strengths of different energy carriers and by minimising waste the strategy aims to achieve deep decarbonisation at the "lowest possible costs" for society.

However, there are already trends that are driving energy system integration in Europe. These include falling costs of renewable energy technologies, innovations in storage systems, electric vehicles and digitalisation. The EU Commission has stated that the strategy will connect the missing links between these trends to create flexible and diverse connections between multiple renewable energy sources, carriers, infrastructures and consumption sectors. Thus, the strategy takes the next step in accelerating and facilitating the necessary integration.

How will the strategy achieve its purpose?

The strategy identifies three complementary and mutually reinforcing elements:

1. A more circular energy system, with energy efficiency at the core.

An increase in energy efficiency will decrease overall investment costs and energy production needs. EU member states will be given guidance on making the principle of energy-efficiency-first operational when implementing EU and national legislation. Another important improvement within this element is to increase the use of local energy sources. A significant unused potential has been identified in waste heat, from local industrial sites and data centres, for example.

The International Energy Agency (IEA) has found that globally about 44% of the required reductions in the energy sector's greenhouse emissions can be achieved through energy efficiency measures, and an additional 36% can be achieved by switching to renewable energy[1]. Eurostat's new statistics on energy consumption for 2018 found that the EU is set to miss the 2020 energy efficiency objective by a margin of up to 5%. Similarly, the EU is not on track to meet its targets for 2030[2].

The Renewable Energy Directive and Energy Efficiency Directive will be revised to reduce waste heat. Another untapped source that will contribute to a more circular energy system is wastewater and biological waste for bioenergy production. This can be used on site, at farms for example, and in combination with renewable energy sources such as solar electricity.

2. Increased direct electrification of end-use sectors

Future electricity demand is bound to increase to enable decarbonisation and climate neutrality. Renewable electricity is becoming cheaper and its use needs to be extended. Especially in highly fossil-dependent sectors such as industry, transport and buildings.

The electricity share of final energy consumption is projected to grow from 23% today to 30% in 2030, and 50% by 2050. This share has only increased by 5% over the last 30 years.

Management of the electricity system at regional and local level will need several policy and legislative developments according to the strategy. One measure that will address this is the development of Regional Coordination Centres in 2022, creating a more robust security analysis, clearer coordination and infrastructure planning, and enhancing the deployment of storage and flexibility options.

3. Use of renewable and low-carbon fuels, including hydrogen, for end-use applications where direct heating or electrification are not feasible

For end-use applications that are harder to decarbonise, such as industry and heavy transport, this is an important element

of the strategy. Rapid action is needed in these sectors. For example at present only 0.05% of total jet fuel consumption originates from liquid biofuels[3].

According to the strategy, renewable gases and liquids produced from biomass or renewable and low-carbon hydrogen can offer storage solutions for the energy produced from variable renewable sources. This would exploit synergies between the electricity sector, gas sector and end-use sectors accordingly. The Commission has launched a parallel communication – "A hydrogen strategy for a climate-neutral Europe" – to address and apply the full potential of hydrogen.

Comments on the strategy

The reactions to the strategy have been a mix of positive and alarmist. Jean-Bernard Levy, CEO of French electricity utility EDF: "On sector integration the Commission got it right: energy efficiency and electrification are the primary drivers to decarbonise the EU economy. Producing renewable and low-carbon hydrogen for maritime transport, aviation and industry is the next frontier."

When it comes low-carbon fossil-based hydrogen the strategy has received negative critique. ECOS welcomes the way that the strategy mainly supports renewable-based hydrogen, as it currently has a minimal share of production. On the other hand, the continued support of low-carbon fossil-based hydrogen is not appropriate even during a transitional phase. Fossil-based hydrogen coupled with carbon capture and storage should not be promoted at the expense of renewable solutions.[4]

Ester Bollendorff, EU Gas Policy Coordinator at Climate Action Network (CAN) Europe express the same worry of low-carbon hydrogen keeping "the door open for the use of dirty fossil fuels and misses out on indicating a fossil gas phase-out date, which will not get us closer or faster to the Paris Agreement objective. We need to reduce our emissions by at least 65% by 2030 already" and adds that "A full decarbonisation of the economy will require the EU to look at energy and non-energy solutions. We should significantly reduce energy demand – it can be halved by 2050 - and multiply renewable energy supply to reach 100% by 2040 - a decade earlier than the current target - with existing and proven technologies. The measures proposed by the Energy System Integration Strategy are not sufficient to move in the needed direction to limit temperature rise to 1.5°C"[5]

In summary, turning the vision of an integrated and flexible energy system into a reality requires resolute action, now. Investments in energy infrastructure typically have an economic life of 20 to 60 years. The steps taken in the next five-to-ten years will be crucial for building an energy system that drives Europe towards climate neutrality in 2050.

Emilia Samuelsson

1. https://www.iea.org/reports/energy-efficiency-2018

2. https://ec.europa.eu/eurostat/documents/2995521/10341545/8-04022020-BP-EN.pdf/39dcc365-bdaa-e6f6-046d-1b4d241392ad

3. https://ec.europa.eu/energy/sites/ener/files/energy_system_integration_strategy_.pdf

4. https://ecostandard.org/news_events/ecos-reaction-to-eu-hydrogen-and-energy-system-integration-strategies-not-without-renewables-and-true-decarbonisation/

Global ship emissions keep on rising

In 2018, worldwide shipping consumed some 330 million tonnes of fuel oil, resulting in emissions of 1056 million tonnes of carbon dioxide. Unless concerted action is taken, these emissions are expected to grow by up to fifty per cent by 2050.

Greenhouse gas (GHG) emissions – including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), expressed as CO_2-equivalents – from all shipping activities around the world increased by nearly ten per cent between 2012 and 2018, according to a recent study for the International Maritime Organization (IMO).

As a result, shipping emissions' share of global anthropogenic emissions of the main GHG carbon dioxide, increased from 2.76 per cent in 2012 to 2.89 per cent in 2018.

Estimates of ships' fuel consumption and emissions vary depending on the methodology applied, and the study used both bottom-up (fleet activity data) and top-down (bunker sales data) methods for its estimates. By using data from the Automatic Identification System (AIS),

the study has produced new emission inventories that distinguish domestic shipping from international emissions on a voyage basis.

This distinction is of some importance, since only voyages between ports in different countries are counted as international shipping. However, even though IMO formally has responsibility only for international shipping emissions, its regulations can be applied to both international and domestic emissions.

According to the study, annual fuel consumption for all shipping activities was approximately 330 million tonnes in 2018, resulting in CO_2 emissions of 1056 million tonnes.

When using the new voyage-based method and focussing only on international shipping (i.e. excluding domestic shipping and fishing vessels), the CO_2 emissions were estimated to amount to 740 million tonnes in 2018.

A breakdown of the overall GHG emissions in 2018 by species type for voyage-based international shipping emissions, shows that the contribution from each of the GHG emission species (CO_2, CH_4, N_2O) to overall CO_2-equivalent emissions is 98, 0.5 and 1.5 per cent respectively.

If emissions of Black Carbon (BC) are also included in the calculation of CO_2-equivalents (using a 100-year Global Warming Potential of 900), then the shares for CO_2, CH_4, N_2O and BC become 91.3, 0.5, 1.4 and 6.8 per cent respectively. In both accounting methods, CO_2 emissions continue, as observed in the Third IMO GHG Study 2014, to dominate international shipping's GHG emissions.

Annual emissions from international shipping of the air pollutants nitrogen oxides (NOx), sulphur dioxide (SO_2) and fine particulate matter ($PM_{2.5}$) increased slightly during the seven-year time period 2012–2018, despite the introduction of stricter emission requirements. In 2018, these emissions were estimated to amount to 17.1, 9.6 and 1.4 tonnes, respectively. (See Table 1.)

Heavy fuel oil (HFO) dominates the fuel consumed by international shipping, with a share of approximately 79 per cent in 2018, down from 86 per cent in 2012. This decrease coincides with an increase in consumption of lower-sulphur marine distillate oil (MDO) after the entry into force in January 2015 of the 0.1% sulphur limit in the Sulphur Emission Control Areas in northern Europe and North America.

According to the IMO's global sulphur monitoring reports, the worldwide average fuel sulphur content in 2018 was 2.59 per cent for heavy fuel oil and 0.07 per cent for marine distillates.

Three types of ship – container ships, bulk carriers and oil tankers – dominate ship fuel consumption and consequently emissions. In combination with chemical tankers, general cargo ships and liquefied gas tankers, these ship types constitute 86.5 per cent of international shipping's total emissions.

It is expected that global demand for shipping will keep growing over the next few decades, resulting in a rise in fuel use and emissions. According to the study, CO_2 emissions from shipping are projected to increase by up to 50 per cent above 2018 levels by 2050 if no additional actions are taken.

The authors note that "emissions could be higher (lower) than projected when economic growth rates are higher (lower) than assumed in the study or when the reduction in GHG emissions from land-based sectors is less (more) than would be required to limit the global temperature increase to well below 2 degrees centigrade."

The International Council on Clean Transport (ICCT), which was involved in preparing the study, concludes that much work lies ahead if the sector is to meet IMO's goal of cutting GHG emissions from international shipping by at least 50 per cent from 2008 levels by 2050. They referred among other things to the fact that over the study period demand for shipping grew twice as quickly as fuel efficiency improved.

"It's notable that improvements in fuel efficiency have slowed since 2015, with annual improvements of only 1 to 2 per cent," said Dr. Dan Rutherford, ICCT's marine programme director. "Policies are needed to accelerate innovative fuel efficiency technologies like wind-assist and hull air lubrication, along with new, low-emission and zero-emission fuels."

Green group Transport & Environment (T&E) said the EU must now activate its plans to include maritime emissions in its carbon market and introduce CO_2 standards for ships while in operation. T&E also pointed to one of the findings of the study, namely that shipping's methane emissions had increased by 150 per cent in the last six years because of the increased deployment of liquified natural gas (LNG) as a ship fuel.

"Shipping's carbon pollution has grown at an alarming rate and could rise by half by 2050 if real action is not taken. Now is the time for the EU to push ahead with its plan for emissions trading for shipping and also quickly adopt the CO_2 standards the European Parliament has called for. Standards will drive the uptake of the hydrogen and ammonia that European shipping needs to decarbonise," said Faig Abbasov, T&E's shipping programme manager.

The report will be presented first to the IMO's Intersessional Working Group on reduction of GHG emissions from ships in mid-October, and then to the IMO's Marine Environment Protection Committee (MEPC 75) to be held in London in mid-November, where it is intended to feed into the ongoing discussions about how to best address GHG emissions from the shipping sector.

Christer Ågren

The report: Fourth IMO GHG Study 2020. International Maritime Organization (IMO) MEPC 57/7/15, 29 July 2020. IMO website: www.imo.org

Table 1: Annual emissions from international shipping 2012 and 2018 (thousand tonnes).

	2012		2018	
	Vessel-based	Voyage-based	Vessel-based	Voyage-based
CO_2	848,000	701,000	919,000	740,000
CH_4	59	55	148	140
N_2O	47	39	51	41
SO_2	10,800	9,100	11,400	9,600
NOx	19,700	16,900	20,200	17,100
$PM_{2.5}$	1,527	1,304	1,589	1,351
BC	73	59	79	62
NMVOC	790	674	861	725
CO	742	628	829	692

Note: The "vessel-based" method for emission inventory is consistent with the one used in the Third IMO GHG Study from 2014, and is based upon vessel type and size, not on a route basis. This new study applied an important new approach, called "voyage-based", which uses the identification of port stops to estimate discrete voyages.

Phase-out ship scrubbers

The International Council on Clean Transportation (ICCT) is calling for all open-loop scrubbers to be converted to closed-loop, and for an eventual ban on the technology.

Ever since the stricter global ship fuel sulphur regulations were adopted by the International Maritime Organization (IMO) in 2008, the use of exhaust gas cleaning systems, also known as scrubbers, on ships as an alternative to switching to cleaner low-sulphur fuel, has been a hotly debated issue.

In a blog posted on the ICCT's website on 28 June, Dr. Bryan Comer argues that all existing open-loop scrubbers should be converted into closed-loop systems. He is also calling for a ban on all new scrubber installations, as well as a prohibition of closed-loop bleed-off water discharges in places that should be protected.

According to the IMO sulphur standards, since 2015, all ships travelling in designated Sulphur Emission Control Areas (SECA) have to comply with a fuel sulphur limit of 0.10 per cent. The SECAs cover two northern European sea areas, the North Sea and the Baltic Sea, as well as the coastal waters (out to 200 nautical miles) of the United States and Canada.

Moreover, from 1 January 2020, the global sulphur limit was reduced from 3.5 per cent to 0.50 per cent, and this applies to all ships in international trade.

Ship operators have different options available to achieve these sulphur limits. The most straightforward option is to switch to using a compliant lower-sulphur fuel oil, i.e. with a sulphur content less than the mandatory limit values. A second option is to switch to using an alternative low- or zero-sulphur fuel, such as liquefied natural gas (LNG), liquefied biogas (LBG) or methanol. And the third is to equip the ship with an exhaust gas cleaning system that reduces the emissions of sulphur dioxide (SO2) to levels that are lower than those resulting from using compliant fuels. Under this last option, ships are allowed to continue to burn residual high-sulphur heavy fuel oil (HFO).

There are primarily two types of scrubbers – open-loop and closed-loop, but there are also hybrid scrubbers that can switch between the open and closed modes. Open-loop scrubbers in particular have been subject to debate, as they use seawater as the "cleansing agent" and produce large amounts of washwater which is discharged into the sea, usually without any treatment. The closed system recirculates the scrubbing water and discharges a lesser volume after treatment.

So far, more than 4,000 ships have installed or ordered scrubbers to avoid using cleaner, but more expensive, low-sulphur fuels (see Figure). As of last year, about 16 per cent of container ships representing 36 per cent of container carrying capacity, had scrubbers installed.

Four out of five scrubbers installed on ships are open-loop, while hybrid scrubbers account for about 17 per cent and closed-loop scrubbers for less than two per cent. Dr. Comer explains that open-loop scrubbers are the most popular because they are the least expensive to install and operate, and adds that: "Hybrid scrubbers cost more, but provide a bit of insurance against local restrictions on open-loop scrubber discharges, as they can be switched to closed-loop or zero-discharge mode. But to avoid collecting and storing scrubber sludge – which needs to be disposed of on land, for a fee of course – hybrid scrubbers are mainly used in open-loop mode. Closed-loop systems are the most expensive and, unlike open-loop systems, continuously collect and store scrubber sludge."

Even though IMO has agreed scrubber discharge guidelines for pH, temperature, polycyclic aromatic hydrocarbons, turbidity, and nitrates, Dr. Comer points out that studies are showing that scrubber washwater and the pollutants it contains damage ecosystems and harm wildlife. He refers to a recent Belgian study that estimates that if 15 to 35 per cent of the fleet (by gross tonnage) operating in the English Channel and the southern North Sea were equipped with open-loop or hybrid scrubbers, each year the pH would drop by between 0.004 and 0.010 pH units, about as much as the ocean acidifies in two to four years due to climate change. Near Rotterdam, the pH decrease was estimated at up to 0.088 pH units per year, which would normally take between 30 and 50 years as a result of climate change alone.

Another study, by the ICCT, focused on Canada's Pacific coast and found that in 2017, 30 scrubber-equipped ships dumped 35 million tonnes of contaminated washwater near British Columbia, including 3.3 million tonnes within the designated critical habitat for threatened and endangered killer whales. Cruise

ships were responsible for 90 per cent of these discharges.

This year, the IMO's Marine Environment Protection Committee is expected to approve a new workplan focused on harmonising the rules for scrubber washwater discharges. Dr. Comer points out that this is an opportunity for IMO to decide when, where, or even if scrubber discharges should be allowed.

Below is a four-step approach, proposed by Dr. Comer for how IMO should proceed under a scrubber workplan. It starts by reducing water pollution from the existing scrubbers and ends with phasing them out completely.

Step 1. Prohibit new scrubber installations. No new or existing ship should be allowed to install a scrubber if it does not already have one installed. All ships should use fuels that comply with the IMO 2020 sulphur regulations.

Step 2. Convert existing open-loop scrubbers to closed-loop. This would allow shipowners who have already spent millions of dollars on scrubbers to continue to use them, but would also dramatically reduce the amount of polluted water that's dumped overboard. Closed-loop systems discharge less than one per cent as much as open-loop systems, but this bleed-off water is acidic and contains a higher concentration of pollutants. So closed-loop scrubbers still pollute.

Step 3. Prohibit closed-loop bleed-off water discharges in places that should be protected. Ships with scrubbers should operate in zero-discharge mode when they are in areas that governments agree should be protected. These could include critical habitats for threatened and endangered species, marine protected areas, particularly sensitive sea areas, estuaries, near-shore areas, or in ports.

Step 4. Phase out existing scrubbers over time. Ships with scrubbers do and will continue to have a market advantage over ships without, because the fuel cost savings of using high-sulphur heavy fuel oil outweigh the capital, operating, and maintenance costs of the scrubber. If new scrubber installations are prohibited, then it's only fair that existing scrubber installations be phased out. The IMO should agree on a timeframe for phasing them out.

According to Dr. Comer, these changes will require IMO member states to amend the International Convention for the Prevention of Pollution from Ships, better known as MARPOL. This process will take several years to negotiate and, if agreed, an additional two years to become enforceable.

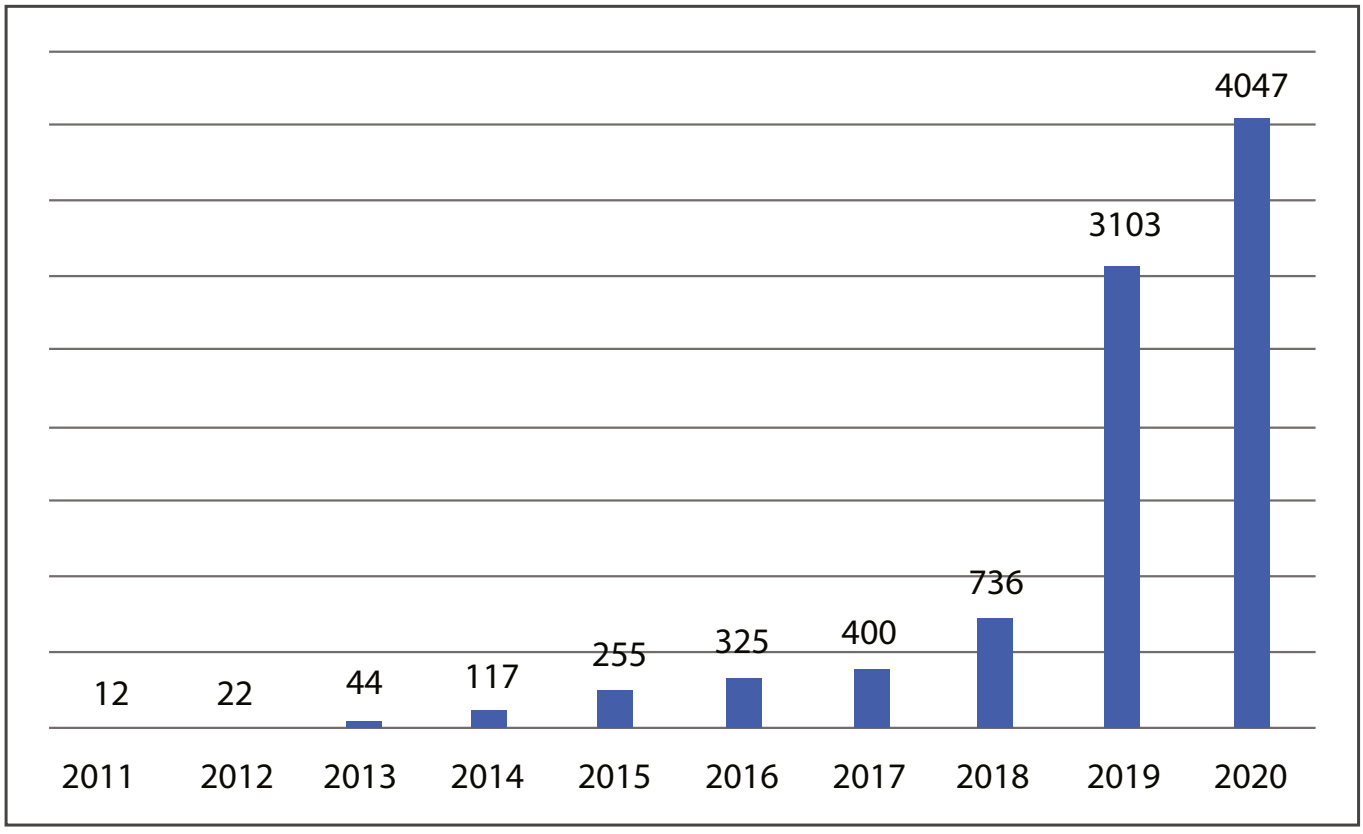
In the meantime, countries, states, and ports can prohibit the use of scrubbers and/or scrubber washwater discharges in the waters they control. Scrubber washwater discharges are already prohibited in all or parts of China, Singapore, several European countries, the Suez and Panama Canals, California, Connecticut, Hawaii, and in major ports such as Fujairah.

Dr. Comer concludes that local actions are a good start but they are not sufficient. The four steps above can serve as a recipe for uniform, global action on scrubbers that closes the open loophole.

Christer Ågren

Source: ICCT blog post by Dr. Bryan Comer. Link: https://theicct.org/blog/staff/scrubbers-open-loophole-062020

Figure: Number of ships with scrubbers installed or on order. Source: Data from DNV GL Alternative Fules Insight Platform



Binding EU air pollution emission limits still breached

In 2018, the national emission ceilings for ammonia were still violated by five member states, although total ammonia emissions seem now to have plateaued after five consecutive years of increase.

As of 2010, the EU's National Emission Ceilings (NEC) directive requires member states to meet national emission limits for their total emissions of four important air pollutants: nitrogen oxides (NOx), ammonia (NH_3), sulphur dioxide (SO_2) and non-methane volatile organic compounds (NMVOCs).

Official emissions data for 2010–2018 reported to the European Environment Agency (EEA) shows however that five countries were still in breach of their limits for NH_3, and one country (Czechia) exceeded its NMVOC ceiling. Germany and Spain have breached their NH_3 ceilings for nine years running. Moreover, in 2018, Croatia, Denmark and Ireland were in non-compliance with their NH_3 limits.

According to the EEA, emissions from agriculture – mainly from the use of fertilisers and the handling of animal manure – were responsible for excessive NH_3 emissions. Emissions of ammonia reduce air quality by increasing the levels of health-damaging secondary particulate matter ($PM_{2.5}$). Ammonia also disrupts land and water ecosystems through eutrophication – the oversupply of nitrogen nutrients with resulting impacts on biodiversity – which currently affects more than two-thirds of the total ecosystem area in the EU.

Between 2017 and 2018, ammonia emissions increased in six member states. But for the EU as a whole they came down by 1.6 per cent, mainly due to reductions in Germany and Italy, reported the EEA.

The emission limits were set in the 2001 NEC directive and are applicable from 2010 until 2019. In 2016, a revised NEC directive was adopted that sets new national emission reduction commitments that are applicable in two steps, from 2020 and 2030, respectively (see AN 1/2017, p.7). Moreover, a fifth pollutant (particulate matter, $PM_{2.5}$) was included in the revised directive.

With the adoption of the new NEC directive in 2016 came a so-called flexibility mechanism that allows member states under certain circumstances to "adjust" downwards their reported emissions for compliance assessment with the national ceilings. This also includes retroactive adjustment for the 2010–2019 period. Following a review and possible approval of member states' applications by the European Commission, the number of

countries deemed to exceed one or more emission ceilings could decrease.

The lack of ambition of the new NEC directive, especially regarding the 2020 reduction commitments, has been strongly criticised by environmental organisations. The EEA analysis now shows that in 2018, the aggregated EU-28 emissions for four of the five pollutants were already below their respective targets for 2020. Only emissions of NOx are slightly above the 2020 target.

Looking at individual countries, the 2018 emission levels suggest that more than half of the countries are likely to attain the emission reduction commitments for the 2020–2029 time period. But more effort will be needed in some countries, especially on NOx, $PM_{2.5}$ and NH_3 emissions.

The slowdown in economic activity in 2020 associated with the COVID-19 lockdowns is expected to lower emissions of several pollutants and may result in more countries meeting their 2020 commitments. However, the EEA notes that without additional efforts, such COVID-19 related reductions might be reversed as the economy starts to recover.

Moving on to the targets for 2030, additional efforts are clearly needed for all pollutants if the EU is to achieve its 2030 emission reduction commitments. The required percentage reductions from 2018 emissions are 38% for NOx; 32% for $PM_{2.5}$; 25% for SO_2; 15% for NMVOCs, and 14% for NH_3.

The EEA concludes that all member states need to lower their 2018 emissions by more than ten per cent for at least one pollutant. In summary:

- All countries need to reduce NOx emissions, and 16 of these must cut emissions by more than 30 per cent. Germany and Malta will need to halve emissions.
- Cyprus, Czechia, Hungary, Poland and Romania will need to halve $PM_{2.5}$ emissions, while Bulgaria, Croatia, Denmark, Portugal, Slovenia and Spain will need to reduce $PM_{2.5}$ emissions by more than 30 per cent.
- Reducing NH_3 emissions will continue to be a major challenge. Half of the countries will need to lower emissions by more than 10 per cent to reach their 2030 commitments. Strong action is required to reduce emissions from the agricultural sector.
- Significant action will be needed in 15 member states to reduce emissions of SO_2 and NMVOCs.

Under the NEC directive, member states have to produce national air pollution control programmes (NAPCP) that set out the additional emission abatement measures needed to achieve their emission reduction commitments for 2020 and 2030. A review of NAPCPs carried out by the European Commission in 2019 indicated that many countries are not on track to meet their 2030 emission reduction commitments (see separate article).

The EEA points out that ensuring consistency between the NAPCPs and the National Energy and Climate Plans should result in an increased level of ambition in future revisions to NAPCPs, and that this requires a focus on delivering synergies in reducing both air pollutants and GHGs, especially across the energy, transport and agricultural sectors.

Christer Ågren

Source: EAA briefing on the NEC directive reporting status 2020 (30 June 2019).

Link: https://www.eea.europa.eu/themes/air/air-pollution-sources-1/national-emission-ceilings/national-emission-reduction-commitments-directive

Note: More detailed emissions data are published by the EEA in the report "European Union emission inventory report 1990–2018 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)", EEA Report No. 8/2020, which is available at: https://www.eea.europa.eu/publications/european-union-emission-inventory-report-1990-2018

Notes:

'✓' indicates that the emission ceiling has been met.

'✗' indicates that the emission ceiling has not been met.

Table: EU member state progress toward meeting 2010 NEC directive emission ceilings.

	NH3									NMVOC									NOx									SO2								
Country Name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2010	2011	2012	2013	2014	2015	2016	2017	2018
EU28	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Austria	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Belgium	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulgaria	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Croatia					✗	✗	✗	✗	✗					✓	✓	✓	✓	✓					✓	✓	✓	✓	✓					✓	✓	✓	✓	✓
Cyprus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Czechia	✓	✓	✓	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Denmark	✗	✗	✗	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Estonia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Finland	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
France	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Germany	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Greece	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hungary	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ireland	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Latvia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lithuania	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Luxembourg	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Malta	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Netherlands	✗	✗	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Poland	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Portugal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Romania	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Slovakia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Slovenia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spain	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sweden	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
United Kingdom	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Above	6	5	4	4	5	5	6	5	5	6	2	1	2	1	1	1	1	1	13	8	7	2	1	1													
Below	21	22	23	23	23	23	22	23	23	21	25	26	25	27	27	27	27	27	14	19	20	25	27	27	28	28	28	27	27	27	27	28	28	28	28	28

The last EU emission standards for road vehicles?

The EU is currently in the process of setting new pollutant emission standards for light and heavy-duty vehicles. In a recent briefing document environmental group Transport & Environment (T&E) says that the future standards (informally called Euro 7/VII) give the EU the opportunity to eradicate pollution from road transport, regain technological and regulatory leadership, and align standards with its new "Zero Pollution Ambition" and the objective of net-zero greenhouse gas emissions by 2050.

While previous Euro standards have reduced emissions from new vehicles with combustion engines, these vehicles are still not clean when all pollutants or driving conditions are taken into account. T&E's recommendations for the post-Euro 6/VI standard include that they should:

- Be the last EU road vehicle emission standards, by setting emission limits at the strictest level globally, be fuel-neutral, apply to all internal combustion engines and define a clear roadmap to zero-pollution;
- Regulate all pollutants that are harmful to public health and the environment, by including smaller particles, ammonia, NO_2 and others that are currently not regulated;
- Improve testing, approval and certification of vehicles to make sure that emission limits apply under all possible driving conditions;
- Ensure that emission limits are met throughout the lifetime of the vehicle.

According to T&E, the new standards must deliver zero-emission mobility as outlined in the European Green Deal by mapping out a clear pathway (in 5-year intervals, starting in 2025) towards only zero-emission new vehicle sales. All new cars and vans should emit zero pollution as well as zero CO_2 by 2035 at the latest, and all new heavy-duty vehicles by 2040.

Link to T&E briefing: https://www.transportenvironment.org/publications/road-zero-last-eu-emission-standard-cars-vans-buses-and-trucks

Rise in plant-based ready meals sold in UK

The UK NGO Eating Better shows in a new report that the proportion of ready meals that is plant-based has increased significantly in UK supermarkets. From 3% in 2018 to 16% in March 2020, plus another 9% when vegetarian meals that are not fully plant-based are included. But more than four out of five ready meals in UK supermarkets still contain animal foods.

Source: https://fcrn.org.uk/research-library/proportion-plant-based-ready-meals-rises.

Phase-out of combustion-engine cars in Europe

A briefing paper by the International Council on Clean Transportation (ICCT) lists announcements by select European local and national governments as well as global car manufacturers to phase out passenger cars with internal combustion engines.

Almost half a dozen countries in Europe have set phase-out targets and dates for combustion-engine passenger cars. In addition to national commitments, almost 30 cities have made plans or have pledged to prohibit combustion-engine cars altogether in urban centres or entire metropolises, with the main aim of improving local air quality, partly focusing on full bans for diesel vehicles at an earlier stage than gasoline-powered cars.

Such announcements are important signals to the EU to put in place a comprehensive phase-out strategy at the EU level, e.g. via the revision of the EU car CO_2 standards. Additional measures, such as allowing member states to mandate national phase-outs and enforce penalties for non-compliance, could provide an additional push for car manufacturers to align their strategies, but the legal basis for such bans has yet to be reviewed at the EU level, according to the ICCT.

The ICCT briefing: theicct.org/sites/default/files/publications/Combustion-engine-phase-outs-EU-May2020.pdf

Eco-label for stoves

Residential burning of wood, coal and gas for home heating is a major source of air pollution, such as health-damaging PM. The EU Eco-design directive addresses air pollution from new household boilers and stoves by setting common standards to cut dangerous emissions. However, Germany has recently obtained the green light from the European Commission to keep enforcing their pre-existing, more ambitious national emission limits.

As neither the Eco-design directive nor the German emission standards reflect "best available techniques" to cut pollution, Environmental Action Germany is now pushing for a new eco-label, based on the German Blue Angel.

To get the Blue Angel certification, a stove must go through a more realistic test procedure, including measurement of the number of particles emitted. The label sets very ambitious emission limit values that will make precipitators or filters mandatory. Furthermore, it includes effective technical provisions to reduce operating errors, such as an automatic combustion air control.

Environmental Action Germany say they expect the first eco-labelled appliances to be sold in 2020, and that they want the eco-label to serve as a minimum standard for stoves that are operated in residential areas. It should also serve as a blueprint for the revision of the EU's Eco-design standards.

Source: EEB META, 11 June 2020. Link: https://meta.eeb.org/2020/06/11/clearing-the-air-around-domestic-heating/

Climate crisis could displace 1.2bn people

1.2 billion people living in 31 countries that are not sufficiently resilient to withstand ecological threats face being displaced within 30 years, according to a new report. Nineteen countries face the highest number of threats, including water and food shortages and greater exposure to natural disasters. The study uses United Nations' and other data to assess 157 countries' exposure to eight ecological threats, then assesses their capacity to withstand them. It found that 141 countries faced at least one ecological threat by 2050, with sub-Saharan Africa, South Asia, the Middle East and North Africa the regions facing the largest number. Some countries, such as India and China, are most threatened by water scarcity.

"Lack of resilience will lead to worsening food insecurity and competition over resources, increasing civil unrest and mass displacement," the report says. It judges Pakistan to be the country with the largest number of people at risk of mass migration, followed by Ethiopia and Iran. The report also states that the world has 60% less fresh water available than it did 50 years ago, while demand for food was predicted to rise by 50% by 2050 and natural disasters were only likely to increase in frequency because of the climate crisis, meaning even some stable states would become vulnerable by 2050.

https://www.theguardian.com/environment/2020/sep/09/climate-crisis-could-displace-12bn-people-by-2050-report-warns

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Heating our climate damages our economies

A PIK study reveals greater costs than expected and that damage from weather extremes would be most costly of all. Previous research suggested that a 1°C hotter year reduces economic output by about 1%, whereas the new analysis points to output losses of up to three times that figure in warm regions and finds significant economic losses: 10% on a global average and more than 20% in the tropics by 2100. This is still a conservative assessment, since the study did not take into account damage from, for example, extreme weather events. Every tonne of CO_2 emitted in 2020 will cause economic damage amounting to between 73 and 142 dollars in 2010 prices. By 2030, the so-called social cost of carbon will already be almost 30 percent higher due to rising temperatures. By way of comparison: the carbon price in European emissions trading currently fluctuates between 20 and 30 euros per tonne, while the national carbon price in Germany rises from 25 euros next year to 55 euros in 2025. These current carbon prices thus reflect only a small part of the actual climate damage. According to the polluter-pays principle, they would need to be adjusted upwards significantly, the study says.

https://www.pik-potsdam.de/en/news/latest-news/heating-our-climate-damages-our-economies-2013-study-reveals-greater-costs-than-expected-1

EU can reach climate neutrality without CCS – German environment agency

The Federal Environment Agency (UBA) outlined measures that demonstrate how EU greenhouse gas emissions (GHG) neutrality is possible without controversial carbon capture and storage (CCS) and with limited amounts of bioenergy, in a study published in November 2019. The study urges efficiency in all energy-consuming sectors (industry, buildings and transport) as well as "far-reaching electrification".

"These measures can reduce the final energy demand (including international transport) by about 37 percent and the share of electricity can be increased to almost 50 percent," according to the study. The paper recommends a "broad portfolio" of renewable energy options as well as substantial quantities of renewable fuels produced from renewable electricity via electrolysis or based on biomass. The study also requires lowering the levels of agricultural and forestry activities. In 2015, agriculture was responsible for 10 percent of EU GHG emissions, according to the study. "A reduction of 95 percent compared to 1990 is not possible without abandoning production and reducing livestock numbers."

https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2019-11-26_cc_40-2019_ghg_neutral_eu2050_0.pdf

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Science worst-case scenario is reality right now

Climate science's worst-case scenario isn't just an awful warning. It describes what is already happening right now. A report from the US Proceedings of the National Academy of Sciences took a closer look at the evidence for climate change in terms of carbon dioxide emissions and climate models, and at cumulative greenhouse gas emissions since 2005. By 2020, the emissions matched the "business as usual" predictions very closely. The study then extended the trends to 2030, and to 2050, with the same outcome. This means that by the end of the century the planet could be 3.3°C to 5.4°C warmer than it was at the start of the Industrial Revolution and the worldwide switch to fossil fuels. The worst-case scenario should remain on the table as a useful risk assessment tool the study concludes.

https://climatenewsnetwork.net/climate-sciences-worst-case-is-todays-reality

Plans to tackle key air pollutants insufficient

In its first report on countries' progress towards EU air pollution goals, the European Commission said that most member states are at risk of missing their binding emission reduction targets for both 2020 and 2030.

The National Emission Reduction Commitments (NEC) Directive is the main legislative instrument to achieve the 2030 objectives of the EU's Clean Air Programme. When fully implemented, the Directive should nearly halve the negative health impacts of air pollution by 2030 (compared to base year 2005), and significantly reduce negative impacts on ecosystems, crops and materials.

Under the NEC directive, member states have to produce national air pollution control programmes (NAPCP) that set out the additional emission abatement measures needed to achieve their emission reduction commitments for 2020 and 2030.

The first NAPCPs were due by 1 April 2019, but only eight member states submitted their final programmes to the Commission on time. Sixteen more submitted their final programmes by May 2020, while two countries – Italy and Luxembourg – submitted only draft NAPCPs by the same date. Two member states – Greece and Romania – have not yet submitted any programme. As a result, these two countries are now facing legal action.

According to the Commission's evaluation of the programmes, most countries are not on track to meet their emission reduction commitments (ERC). Member states which do not expect to achieve their ERCs with current policies have to report the additional policies and measures that they considered for adoption and those actually selected in order to fulfil their commitments.

However, the analysis shows that the NAPCPs often lack the information needed. Some examples:

- Quantified emission reductions are provided for only a small proportion of the "Policies and measures" (PaM), which leads to uncertainty regarding the credibility of the measures and the extent to which they can contribute to meeting national emission reduction commitments.
- In certain sectors about half of the PaMs reported actually relate to already existing (or already adopted) measures

Table: Assessment of the risk of non-compliance with emission reduction commitments of the NEC directive (Annex 3 of the Commission's implementation report).

	2020-2029					2030 and beyond				
	SO2	NOx	NMVOC	NH3	PM2.5	SO2	NOx	NMVOC	NH3	PM2.5
Austria	L	L	M	H	L	L	H	M	H	H
Belgium	L	L	L	M	L	L	L	L	M	L
Bulgaria	M	H	H	H	L	L	H	H	H	L
Cyprus	L	M	M	L	M	M	L	M	L	H
Czechia	L	H	H	H	L	L	H	H	H	L
Germany	L	L	L	H	L	L	M	M	M	M
Denmark	L	L	L	H	H	H	L	L	H	H
Estonia	M	M	M	H	M	L	M	L	H	M
Greece	-	-	-	-	-	-	-	-	-	-
Spain	L	L	M	M	L	L	L	H	M	M
Finland	M	M	M	H	M	M	M	H	M	M
France	M	M	M	H	M	M	M	M	H	H
Croatia	L	L	M	M	M	L	L	M	M	M
Hungary	-	-	-	-	-	-	-	-	-	-
Ireland	L	L	H	H	L	M	H	H	H	L
Italy	-	-	-	-	-	-	-	-	-	-
Lithuania	M	H	H	M	M	M	H	H	H	H
Luxembourg	-	-	-	-	-	-	-	-	-	-
Latvia	-	-	-	-	-	-	-	-	-	-
Malta	-	-	-	-	-	-	-	-	-	-
Netherlands	L	H	M	H	M	M	H	M	H	H
Poland	H	H	H	H	M	H	H	H	H	H
Portugal	M	H	H	H	M	H	H	H	H	H
Romania	-	-	-	-	-	-	-	-	-	-
Sweden	L	L	L	H	L	L	H	L	H	L
Slovenia	M	H	M	M	M	H	M	H	H	H
Slovakia	-	-	-	-	-	-	-	-	-	-
United Kingdom	M	M	M	H	H	H	H	H	H	H
High risk	**1**	**7**	**6**	**14**	**2**	**5**	**10**	**10**	**14**	**10**
Medium risk	**8**	**5**	**10**	**5**	**10**	**6**	**5**	**6**	**5**	**5**
Low risk	**11**	**8**	**4**	**1**	**8**	**9**	**5**	**4**	**1**	**5**
Not assessed	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**

Legend:
H = high risk
M = medium risk
L = low risk
- = not assessed due to late or non-submission

and thus belong in the "With Measures" scenario rather than in the "With Additional Measures" scenario.

The Commission concludes that "overall, there is insufficient information provided in the NAPCPs about the PaMs to confidently confirm their credibility; information is in particular lacking as regards the projected uptake of the PaMs, their implementation timescale and the level of emissions reductions foreseen."

An assessment was also made of the risk of non-compliance with the emission reduction commitments, based on the joint analysis of the quality of projections, the credibility of the PaMs selected for adoption in the NAPCPs, and the projected margin of compliance.

It concluded among other things that, for 2020–29 ERCs, out of twenty member states considered in the analysis, fourteen would be at high-risk of non-compliance with ERCs for ammonia (see Table).

As regards the 2030 ERCs, there is even more reason for concern, with more than half of the member states analysed being at high risk of non-compliance with ERCs for four of the five air pollutants (the exception being SO_2). It is concluded that "further measures, additional to the ones presented in the NAPCPs, should therefore be put in place in these member states in order to reduce such risk."

In its press release, the Commission concludes that most member states are at risk of not complying with their 2020 or 2030 emission reduction commitments and that efforts are especially needed in agriculture to reduce ammonia emissions, which is the most common and severe implementation challenge across the EU.

Effective implementation of clean air legislation is also essential for the Commission's "Zero-pollution ambition for a toxic-free environment" and related initiatives, such as the "Zero-pollution action plan for water, air and soil", as announced in the European Green Deal from December 2019.

EU Environment Commissioner Virginijus Sinkevičius said: "This report sends a clear message. All across Europe, too many citizens are still at risk from the air they breathe. We need more effective measures to cut pollution in numerous member states and to tackle air emissions across sectors, including agriculture, transport and energy. There has never been a better time to make these changes: investing in cleaner air means investing in citizens' health, in our climate, and it's the kick-start our economy needs."

Alongside the implementation report, the Commission on 26 June also released its consultants' analysis of each member state's NAPCP and emission projections, as well as an EU-wide horizontal report bringing together this information.

The implementation report will be followed later this year by a Second Clean Air Outlook report, which will present updated modelling results on the extent to which the EU and its member states are on track to meet their clean air objectives for 2030 and later.

Christer Ågren

Report from the Commission to the European Parliament and the Council on the progress made on the implementation of Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (COM(2020) 266 final).

Review of National Air Pollutant Projections and Assessment of National Air Pollution Control Programmes. Intermediate Horizontal Review Report for European Commission – DG Environment. By Ricardo Energy & Environment.

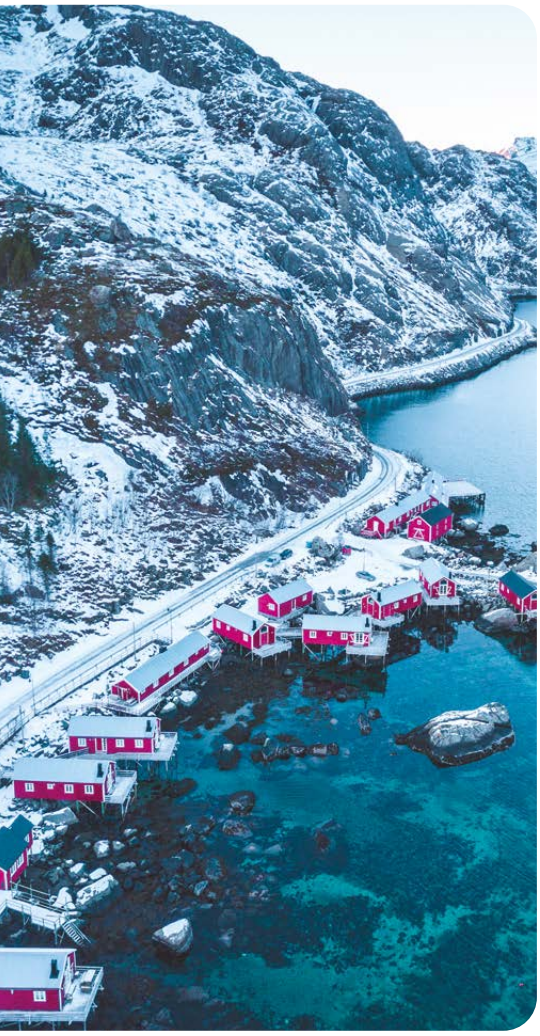
Link: https://ec.europa.eu/environment/air/index_en.htm

Dirty air endangers World Heritage Sites

Air pollution can destroy our cultural heritage, including historical buildings and monuments. A recent study under the Air Convention evaluated risks of potential damage and associated costs due to air pollution for 21 UNESCO World Heritage Sites in six countries: Croatia, Germany, Italy, Norway, Sweden and Switzerland.

Corrosion and soiling by dirty air can lead to severe economic losses through high maintenance and restoration costs. For example, the total annual cost of maintenance work from soiling of the limestone surface of the Colosseum in Rome, Italy, was estimated to be about €680,000 per year.

Source: UN ECE press release, 11 May 2020. Link: https://www.unece.org/info/media/presscurrent-press-h/environment/2020/dirty-air-endangers-unesco-world-heritage-sites-and-produces-high-costs/doc.html.



Methane rises to highest level on record

Animal farming and fossil fuels have driven global emissions of methane to the highest level on record, according to new data from the Global Carbon Project. Since 2000, emissions have risen by nine per cent (approximately 50 million tonnes a year), and concentrations are currently increasing at a rate of around 8–12 parts per billion (ppb) per year.

Source: The Guardian, 14 July 2020
Further information: https://www.globalcarbonproject.org/methanebudget/

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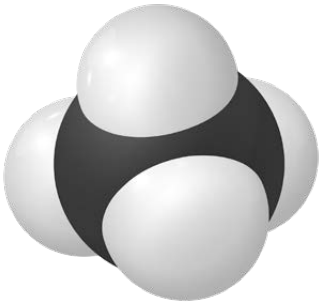

Greenhouse gas production from aquaculture

Global aquaculture accounted for around 0.49% of anthropogenic greenhouse gas emissions in 2017, approximately the same level as emissions derived from sheep meat production. These are findings from a recent study that quantified the global GHG emissions from aquaculture (excluding the production of aquatic plants). When emissions are measured per kilogram of food, aquaculture shows a lower emission intensity than meat from buffalo, cattle, goats and sheep, while the production of meat from pigs and chickens show a similar emission intensity as aquaculture.

The relatively low emission intensity of aquaculture was attributed to the absence of methane production in the digestive system of the fish, together with the high fertility of fish and their efficient conversion of feed into edible product.

Aquaculture production is an important part of global food security, and awareness of its contribution to GHG emissions and how to mitigate them is important for expanding aquaculture sustainably.

Report: https://www.nature.com/articles/s41598-020-68231-8

Shipper MSC in top 10 list of EU carbon polluters

The Mediterranean Shipping Company (MSC) overtook Ryanair in the top 10 rankings of the EU's biggest carbon dioxide emitters in 2019. Data compiled by Transport & Environment (T&E) showed MSC emitted an estimated 10.72 million tonnes of CO_2 in 2019, ranking it seventh in the EU, rising above Ryanair at No. 8, which produced an estimated 10.53 million tonnes.

Both MSC and Ryanair still emit less CO_2 than the biggest coal-fired power plants in the top 10 list. Six German plants and two Polish plants make up the rest of the list, with Poland's Belchatow power station the biggest polluter.

Source: Reuters, 3 July 2020

T&E press release: https://www.transportenvironment.org/press/top-shipping-polluter-overtakes-power-plants-coal-shuts-down

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French government faces heavy fine

The French government will be fined €10 million every six months if it does not reduce air pollution in line with the law, the Council of State, the country's highest administrative court, said on 10 July. Following complaints by environmental organisations, the council ordered the government in July 2017 to take measures to reduce nitrogen dioxide and particulate matter pollution in several regions to bring them in line with the EU Air Quality Directive.

"The council notes that the government has not taken the necessary steps to reduce air pollution in eight zones," it said in a statement, adding that the fine would be the highest penalty it has ever issued. The fines paid by the state would be transferred to environmental organisations, the council said, adding that the fines could also be increased.

Source: Reuters, 10 July 2020.

Germany sued over air pollution failures

ClientEarth and Environmental Action Germany in May lodged a legal challenge with the Higher Administrative Court of Berlin and Brandenburg, in relation to flawed national air pollution control programmes that put Germany on track to miss legally binding emission reduction targets for four out of five pollutants in 2030.

Lawyer Caroline Douhaire, who is representing the organisations in the case, said: "Germany has never been a model student when it comes to implementing EU air quality law. The ongoing breaches of NO_2 limits in cities across Germany have prompted multiple court rulings against authorities, as well as an EU-level case against the country itself. The German government must not make the same mistake in reducing national emissions under the NEC Directive. We need measures in place now to secure the right emissions reductions in time – and currently, this is not what we're seeing."

Source: ClientEarth media release, 26 May 2020. Link: https://www.clientearth.org/press/germany-sued-over-major-national-air-pollution-failures/

UK government proposes new law to prevent illegal deforestation in supply chains

The new law that is proposed by the UK government requires large companies to ensure that the supply chain commodities they use, such as soy, beef and palm oil, have not been produced on illegally deforested land. Further, they must show that they have taken proportionate action to prove that this is the case. The new law is intended to restrict the global problem of illegal conversion of forests and other important natural areas into agricultural land. The law proposal is currently up for consultation in the UK government.

Source: https://fcrn.org.uk/research-library/proposed-uk-law-restricts-illegal-deforestation-supply-chains

High emissions from domestic solid-fuel burning

Burning just 2–3 kg of coal, briquettes, peat sods or wood produce the same amount of particulate matter (PM) as driving a typical, modern diesel car for several thousand kilometres, according to a study by University College Dublin, published by the Irish Environment Protection Agency.

The emission factors were obtained using a domestic stove designed to current standards, and they represent emissions over the complete combustion cycle, from ignition through to extinction. The study covered several fuel types: sod peat, peat briquettes, bituminous and smokeless coals, hardwood, softwood as well as firelighters.

The authors conclude that smoky coal bans "while laudable in principle" are ineffective and that all combustion of solid fuels in manually operated, domestic appliances in urban areas should be discouraged instead.

Source: Independent.ie, 11 July 2020.

The report "Emission Factors from Domestic-scale Solid-fuel Appliances": http://www.epa.ie/pubs/reports/research/climate/research324.html

NO_2 in German cities

A new report by the German Federal Environment Ministry (BMU) shows that nitrogen dioxide (NO_2) concentrations exceeded the air quality limit of 40 micrograms of NO_2 per cubic metre of air ($\mu g/m^3$) per year in 25 cities in 2019, compared to 57 cities in 2018.

On average, the annual mean NO_2 values in 2019 at measuring stations close to traffic were around 4 $\mu g/m^3$ lower than in 2018. The reasons for the decline were: Local measures such as speed limits, driving bans or the use of less polluting buses; nationwide measures such as software updates; funding under the programme "Clean Air 2017–2020"; the renewal of the vehicle fleet with vehicles that in real operation have lower NOx emissions; and meteorological influences that affect the spread of air pollutants.

Source: AECC Newsletter, June 2020.

The BMU press release (in German): www.bmu.de/pressemitteilung/stadtluft-wird-sauberer-zahl-der-staedte-ueber-dem-no2-grenzwert-halbiert-sich-im-jahr-2019.

EU infringement actions on air pollution

In May, the European Commission issued a reasoned opinion, threatening to take Slovenia to the EU Court of Justice if it does not comply within four months with the Air Quality Directive. Slovenia failed to ensure compliance with the limit values for PM_{10} in Celinsko Obmocje and has not taken appropriate measures to keep exceedance periods as short as possible.

Romania was sent a formal notice over infringements of the same directive, with the threat of a reasoned opinion to follow if action is not taken within four months to reduce levels of NO_2.

Bulgaria and Poland were cautioned for not allowing citizens to challenge public authorities over the air quality plans required under EU law, while France, Cyprus and Lithuania were similarly cautioned over failures to fully incorporate the National Emissions Ceiling Directive into national law.

Source: Ends Europe Daily, 14 May 2020.

The full 14 May infringements package: https://ec.europa.eu/commission/presscorner/detail/en/inf_20_859

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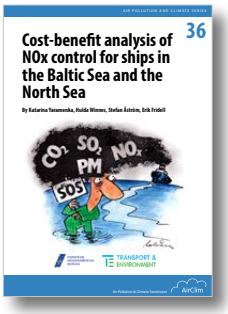
Climate and Health (September 2020). By Björn Fagerberg, Bertil Forsberg, Sofia Hammarstrand, Laura Maclachlan, Maria Nilsson and Anna-Carin Olin.



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

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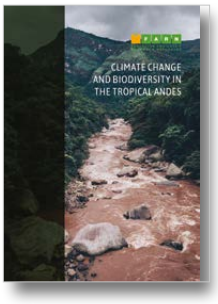
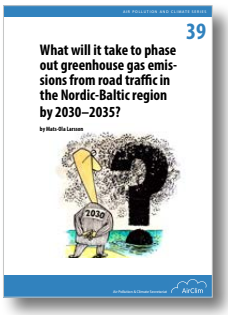
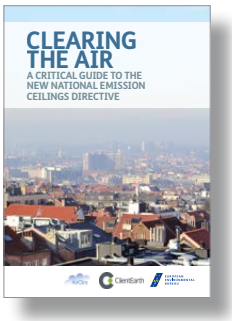


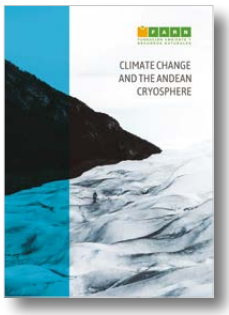
Climate change and Biodiversity in the Tropical Andes (2020). By Catalina María Gonda Two major crises pose severe threats for life on Earth.



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



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



Climate change and the Andean Cyrosphere (2019). By Catalina María Gonda The cryosphere has unique functions and influences the physical, biological and social systems.

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

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Coming events

UK Clean Air Day 8 October 2020. Organised by Global Action Plan. Information: https://www.globalactionplan.org.uk/clean-air/clean-air-day

IMO 7th Intersessional Working Group on reduction of GHG emissions from ships. Remote meeting, 19 - 23 October 2020. Information: www.imo.org

EU Environment Council. Brussels, 23 October 2020. Information: www.consilium.europa.eu/en/press/calendar/

2020 Annual POLIS Conference. Arnhem-Nijmegen City Region, Netherlands, 2 - 3 December 2020. Information: https://www.polisnetwork.eu/2020-annual-polis-conference

IMO Marine Environment Protection Committee (MEPC 75). Remote meeting, 16 - 20 November 2020. Information: www.imo.org

CLRTAP joint meeting of Executive Body and Working Group on Strategies and Review. Geneva, Switzerland, 14 - 18 December 2020. Information: www.unece.org/env/lrtap/welcome.html

EU Environment Council. Luxembourg, 17 December 2020. Information: www.consilium.europa.eu/en/press/calendar/

International Transport and Air Pollution (TAP) Conference. Graz, Austria, 30 - 31 March 2021. Information: www.tapconference.org

Air Pollution threats to Plant Ecosystems Conference. Paphos, Cyprus, 17 - 21 May 2021. Information: http://www.ozoneandplants2020.com

UN FCCC Bonn Climate Change Conference. Bonn, Germany, 31 May - 10 June 2021. Information: http://unfccc.int/

UN FCCC COP26. Glasgow, UK, 1 - 12 November 2021. Information: http://unfccc.int/