Methane emissions are the low-hanging fruit of the climate transition

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Methane is well known for coming from ruminants digestive system. What is less known is its important role in current climate change and what we could do to drastically reduce our emissions.

Methane (CH_4) is the second main greenhouse gas after carbon dioxide (CO_2). However, while CO_2 will persist in the atmosphere for centuries, methane reacts with other air molecules. The lifetime of methane in the atmosphere is approximately nine years, before it is consumed into CO_2. CH_4 molecules also have a much stronger warming potential than carbon dioxide: 84 times larger on a 20-year time scale. That's why reducing methane emissions can have immediate and relatively effective impact on our climate.

The European Union (EU) has recently voted unprecedented measures to reduce our emissions, but what is concerned by this law?

What emits methane?

In Europe, emissions are mainly from agriculture (38% in 2022, JRC 2023), through the digestive system of ruminants. More generally, methane is a product of fermentation, and it is also emitted by the degradation of our waste, and naturally in stagnant water.

A significant part (globally 30% in 2017 Saunois et al., 2020) of anthropogenic emissions, meaning from human activities, comes from the fossil fuel industry. Unlike CO_2, that is formed when burning fuel, CH_4 is fuel. It is a natural gas that can directly be used in our boilers. The subsurface reservoirs of other fossil fuels, solid and liquid, are associated with the presence of natural gas. This gas escapes during the exploitation, transport, storage and use of coal, oil, and also natural gas.

Still now, the extraction and the distribution of fossil fuels creates some fugitive emissions of methane. They go from small leaks to massive blowouts, like it happened in the United States in 2019 and more recently in Kazakhstan. The methane released to the atmosphere in six months from this singe leak compared with the annual energy needs of 500,000 households.

In Europe, the majority of methane emissions caused by the fossil fuel industry is from leaks. But the operators were until now not required to control nor even measure these losses.

The case of Romania

To reduce the greenhouse gas emissions of this sector, reliable information is needed. We need to know where and how much methane is leaking in the fossil fuel supply chain. To improve this quantification, scientists combine several direct measurement methods, and use interpolation techniques based on atmospheric models to estimate regional emissions as precisely as possible.

In 2019, we focused on Romania, one of the largest oil and gas producers of the EU BP, 2022. Romania reported historically large methane emissions, that seemed to decrease with the decrease in production. But the reported numbers are inconsistent: for example the emissions reported for the year 2000 were almost two times larger in the 2018 report compared to the 2015 report.

To shed light on these emissions, we carried out measurements with vehicles, drones and aircraft in the southern part of the country, where most of the oil production is located. Our teams involved a total of 70 people, that used five different quantification methods of CH_4 fluxes.

Our estimates of the total Romanian oil-related methane emissions were two to five times larger than the reported ones. We also used infrared cameras to directly film the leaks, and found more than half of the installations leaking. Most of the time, it came from open-ended pipelines releasing free methane (venting), whereas regular practices include gas flaring. Flaring is the burning of CH_4 into CO_2, a less potent greenhouse gas. Venting is the direct release of the natural gas from the subsurface reservoirs, and mostly composed of methane.

Additionally, we observed that less methane was measured around sites where the dangerous gas hydrogen sulfide is part of the gas mixture. This proves that the operator is able to monitor and reduce leaks for security reasons, but is not as careful for all installations.

Our conclusions show that resources are being wasted, but also that an immediate reduction of greenhouse gas emissions is possible.

An opportunity to improve

The solutions do not require new technologies, and should be applied on a global scale. The operators just need to regularly monitor and repair the leaks, as well as maintaining the equipment to prevent cracks. Gas venting and flaring practices need to change toward capture to collect and use the gas. In many or most cases the cost of the modification of the infrastructure will be overcompensated by a revenue from the gas that can now be sold instead of leaking into the air.

These measures have no cost, and if implemented in the oil, gas and coal industries before 2030, could reduce the current global warming by 0.2°C in 2100. The reduction could be of 0.5°C if we apply simple no-cost measures on other methane emitting activities.

The challenge is to repair those leaks on a global scale, because the situation is probably similar or worse in other fossil fuels production regions.

The EU is the largest oil and gas importer in the world: 97% of its oil, and 90% of its gas is imported. The responsibility of the EU is to impose changes in fossil fuels extractions practices not only within its territory. Our campaign in Romania has contributed to increased awareness of this potential by EU politicians. To start, the Commission came with the Global Methane Pledge during COP26, signed by more than 100

countries.

Things are starting to change

In 2020, the European Commission announced the creation of the international methane emissions observatory (IMEO). Then, in November 2023, came a series of measures designed to tackle methane emissions from the fossil fuel industry, as part of the "European Green Deal," and passed by a majority vote on 10 April 2024. This includes, for operating companies

- the obligation for operators to regularly quantify and report their methane emissions
- the obligation to regularly check for leaks and repair them
- a ban on routine degassing and flaring at oil and gas operations
- restrictions on degassing in coal mines from 2027, and more strictly in 2031
- the obligation to make an inventory of abandoned or inactive facilities, and to monitor and mitigate their methane emissions.

Finally, the text includes the extension of these standards to international oil, gas and coal imports by 2027, on pain of non-renewal of contracts.

It's a victory to have finally obtained measures to regulate these unnecessary emissions, and Romanian operators have already started to implement them. However, the IMEO is coordinating new measurement campaigns to verify and quantify the reductions. The acquisition of public and independent scientific data on these usually confidential activities has changed the situation, and must continue. Methods are now available to integrate our results into the greenhouse gas emission inventories that serve as a basis for negotiations.

We hope that the new European standards will be applied systematically.

The challenge is for them to serve as a basis for cleaner practices on a global scale. Even so, this is only a first step, because if we are to limit future warming, we will above all have to drastically reduce our dependence on resources that have taken millions of years to settle beneath our feet.

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