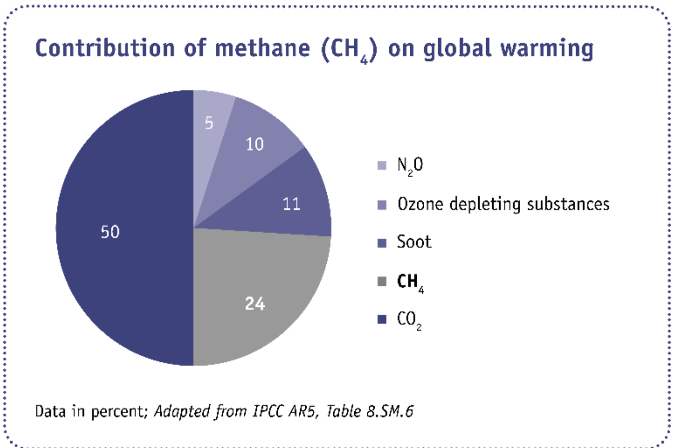
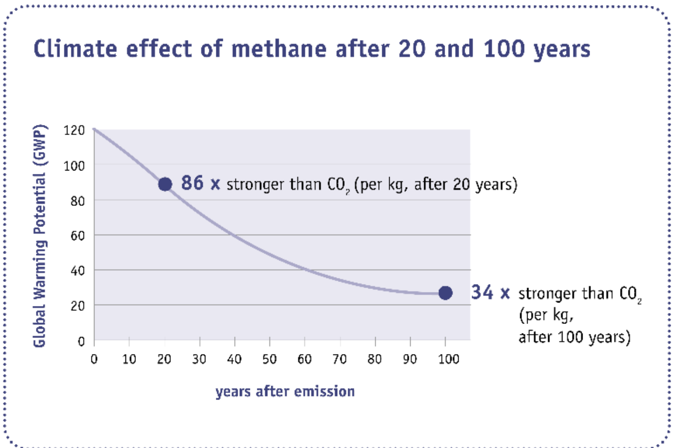
FAQs on methane emissions from the gas industry

What is the role of methane in global warming?

Methane (CH4) is one of the most climate-damaging greenhouse gases and it is currently increasing at a rate of around 1% per year.[1] In the long term, it is responsible for almost a quarter of the greenhouse effect and thus the second largest factor in global warming after CO_2.[2] Compared to CO_2, methane only stays in the atmosphere for a short period of around twelve years. At the same time, it is an extremely potent greenhouse gas that has a warming effect that is 86 times greater than that caused by CO_2 over a 20-years period.[3] This short-term effect is particularly relevant regarding the Paris Agreement target of keeping global warming below 1.5 degrees. It also increases the risk of exceeding irreversible climate tipping points, such as the thawing of permafrost soils or the melting of the Greenland ice sheet, which could already be reached in the coming years. Accordingly, there is an urgent need to reduce our methane emissions as quickly as possible.





Graphics source: See Schwietzke, S., 2019 and IPCC, 2013 [2,3]

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[1] *European Space Agency, 2020, "Mapping methane emissions on a global scale", available on 29.05.2020 under http://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-5P/Mapping_methane_emissions_on_a_global_scale*

[2] *Schwietzke, 2019, presentation "Methanemissionen der Erdgasindustrie – Messungen und Erkenntnisse", Environmental Defense Fund, available on 29.05.2020 under https://www.dgs.de/fileadmin/newsletter/2019/EDFE_Vortrag_Wissenschaft_Methanemissionen_Schwietzke_10092019%20%281%29.pdf*

[3] *IPCC, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

What are the main sources of human-made methane emissions?

Methane is the main component of natural gas. Depending on the source, it amounts to a proportion of between 75 and 99%, highlighting the threat methane emissions pose to the climate. In Germany, the energy sector – meaning the oil and gas industry – is the second-largest source of methane emissions, after the agricultural sector and before the waste industry.[4]

Recent satellite measurements have found that half of the world's 100 largest methane leaks can be traced to oil, gas and other heavy industry.[5] The methane emitted by these sectors is equivalent to the yearly CO_2 emissions of Germany and France combined.

Where do methane emissions occur in the gas industry?

The gas industry produces methane emissions along the entire value chain, i.e. during:

- extraction,
- production,
- processing,
- transport,
- distribution,
- storage,
- and final use. [6]

During transportation, for example, methane can leak due to the high pressure with which the gas is passed through the transport network. This causes methane leakages to occur along weak spots in the pipeline like at shut-off valves, compressor stations or transport fans.[7] In addition to these diffuse sources, emissions are also caused by deliberate pressure release or incomplete flaring.[8] Finally, methane often escapes directly from boreholes during but also after the extraction period. [9]

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[4] Gusev, A., Cremonese, L., 2016, "Die ungewissen Klimakosten von Erdgas", IASS Potsdam, available on 27.04.2020 under https://www.iass-potsdam.de/de/ergebnisse/publikationen/2016/die-ungewissen-klimakosten-von-erdgas-bewertung-der-unstimmigkeiten

[5] European Space Agency, 2020, "Mapping methane emissions on a global scale", available on 29.05.2020 under http://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-5P/Mapping_methane_emissions_on_a_global_scale

[6] Oil Change International, 2018, „Debunked: The G20 Clean Gas Myth", verfügbar am 27.07.19 unter http://priceofoil.org/2018/06/11/debunked-g20-clean-gas-myth/; UBA, 2018, Kurzstudie „Bewertung der Vorkettenemissionen bei der Erdgasförderung in Deutschland", S. 9.

[7] UBA, 2018, Kurzstudie „Bewertung der Vorkettenemissionen bei der Erdgasförderung in Deutschland", p. 9.

[8] UBA, 2018, Kurzstudie „Bewertung der Vorkettenemissionen bei der Erdgasförderung in Deutschland", p. 10; International Energy Agency, „Methane Tracker - Reducing methane emissions from oil and gas operations", available on 04.09.2019 under https://www.iea.org/weo/methane/database/

[9] Chesnaux, Romain, 2020, "A tenth of active and abandoned oil and gas wells in northeastern B.C. are leaking" The Conversation, 02.03.2020, available on 17.04.2020 under https://theconversation.com/a-tenth-of-active-and-abandoned-oil-and-gas-wells-in-northeastern-b-c-are-leaking-127921

How much methane escapes from the gas industry supply chain?

Estimates of how much methane escapes along the gas supply chain vary widely. However, scientific publications that rely on measurements rather than estimations usually present higher leakage rates than the industry itself. The first independent measurements on plants in the American gas industry, for instance, show 60% higher leakage rates than those published by the US Environmental Protection Agency.[10] In sum, these add to leakage rates of around 2.3%, based on the total volume of gas delivered by the USA.[11] Current satellite measurements are even more troubling and show values of up to 3.7%[12] whereas other studies sometimes produce values between 2.8 and 9.0%.[13] Highlighting the downsides of fracking technology to extract natural gas, studies moreover show that up to 12% of the gas extracted by this method escapes into the atmosphere.[14] Since natural gas loses its climate advantage over coal as soon as between 2.4 and 3.2% of the total production escapes into the atmosphere[15] and it is estimated that the leakage rate of fracking gas can at best be reduced to 3.8%, fracking gas is no option for the future.[16] Taken together, these numbers run counter to the popular narrative that fossil gas can bridge the transition from coal to renewables.

Why have methane leaks in the gas industry been underestimated so far?

One of the main reasons for the systematic underestimation of methane leakages are missing or inaccurate measurements.[17] The US Environmental Protection Agency, for example, seems to overlook emissions that occur under unusual operating conditions.[18] For countries such as Russia, the only data often comes from the industry itself, while independent measurements typically remain unavailable.[19] Depending on the region, widely divergent figures are often reported. Reports on methane emissions in Europe and Germany are also often based on outdated data.[20]

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[10] Howarth R., 2015, Methane emissions and climatic warming risk from hydraulic fracturing and shale gas development: implications for policy. Energy and Emission Control Technologies ;3:45-54 https://doi.org/10.2147/EECT.S61539, available on 15.04.2020 under https://www.dovepress.com/methane-emissions-and-climatic-warming-risk-from-hydraulic-fracturing--peer-reviewed-article-EECT

[11] Alvarez et al., 2018, "Assessment of methane emissions from the U.S. oil and gas supply chain", Science, available on 11.09.2019 under https://science.sciencemag.org/content/361/6398/186

[12] Zhang et al, 2020, "Quantifying methane emissions from the largest oil-producing basin in the United States from space", Science Advances, DOI: https://10.1126/sciadv.aaz5120

[13] Hope, M., 2014, "Explained: Fugitive methane emissions from natural gas production", Carbon Brief, 03.07.2014, available on 17.04.2020 under https://www.carbonbrief.org/explained-fugitive-methane-emissions-from-natural-gas-production

[14] See Howarth R., 2015

[15] See Howarth, R., 2015

[16] Howarth, R., 2014, „A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas", Energy Science & Engineering, 2(2), p. 47–60. https://doi: 10.1002/ese3.35, p. 53, available on 15.04.2020 under https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.35; Hope, M., 2014 und European Commission, 2018, In-Depth Analysis in Support of the Commission Communication COM (2018) 773: A Clean Planet for All: A European Long-Term Strategic Vision for a Prosperous, Modern, Competitive and Climate Neutral Economy. P. 51, footnote 128. Available on 17.04.2020 under https://ec.europa.eu/knowledge4policy/node/33097_de

[17] See Howarth, R., 2014, p. 48

[18] See Alvarez et al., 2018

[19] Van Renssen, S., 2019, US Scientist: Methane leakage reports 'have an inherent low bias', Euractiv.com, 20.11.2019, available on 17.04.2020 under https://www.euractiv.com/section/energy-environment/interview/us-scientist-methane-leakage-reports-have-an-inherent-low-bias/

[20] Gusev, A., Cremonese, L., 2016, "Die ungewissen Klimakosten von Erdgas", IASS Potsdam, am 27.04.2020 verfügbar unter https://www.iass-potsdam.de/de/ergebnisse/publikationen/2016/die-ungewissen-klimakosten-von-erdgas-bewertung-der-unstimmigkeiten

How do methane emissions compare in different gas exporting countries?

Methane emissions before import differ a lot depending on the country where the natural gas is extracted. In fact, the poor data situation only allows estimates of how high emissions in the upstream supply chain (i.e. from extraction, production and transport in the country of origin) really are. For the twenty largest natural gas producers, including the USA and Russia, the official figures correspond to a leakage rate of 1 to 2%. Yet, other countries like Norway do not report any significant leakage whatsoever. Overall, there are great differences between the information provided by countries. This cannot be explained by different methods, nor by different legal regulations.[21]

The fact that newer and independent measurements, such as in the USA, tend to show higher leak rates than officially stated, shows that there is a lack of thorough, uniform, frequent, independent, and comparable data collection. It is therefore likely that methane emissions are significantly higher than currently assumed. The exact impact of this problem for the climate is thus unknown.

If fracking gas from countries like the USA will be imported in the future, the amount of methane emissions caused by those countries will continue to rise, not least because US industry regulations were slashed considerably in recent years. At the same time, fracking companies there often form quickly and go bankrupt just as quickly, leaving unattended boreholes from which methane can escape. Methane is currently leaking from two of the three million closed drilling sites in the United States. This could also be a reason for the massive increase in atmospheric methane observed over the last 10 years as scientists attribute this primarily to the oil and gas industry. The US fracking boom US alone could be responsible for over half of this increase.[22]

What measures can be taken to reduce methane leakages?

The quality of gas infrastructure has a decisive influence on the frequency and extent of methane leakages. If the infrastructure is not sufficiently developed, gas is often intentionally flared or vented into the atmosphere. Inadequate regulation can also incentivize companies to dispose of excessive gas in this way rather than collecting it.[23]

A well-developed infrastructure can accordingly help to reduce leakages. Strict legal regulations moreover ensure that operators do the necessary investments instead of saving in the wrong places. Collected gas can, for instance, be reconditioned and resold or pressed back into the ground.[24] Specifically, by regularly running programs for leak detection and repair (LDARs), leaks on seals, pumps, or connectors can be detected and eliminated before gas can escape over a long period of time. Monitoring, reporting and verification (MRV) standards also have a crucial role in providing accurate data on methane leakages and indicating where action needs to be taken.

Nevertheless, the reduction of leaks also has technical limits as it is practically impossible to completely avoid leaks. For instance, if boreholes are closed with cement, the drying process can create gaps through which gas can escape.[25]

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[21] *See Gusev, A., Cremonese, L., 2016*
[20] *Leahy, S., 2019, „Fracking boom tied to methane spike in Earth's atmosphere", National Geographic, 15.08.2019, available on 01.09.2020 under https://www.nationalgeographic.com/environment/2019/08/fracking-boom-tied-to-methane-spike-in-earths-atmosphere*
[21] *See Leahy, S., 2019*
[23] *See Zhang et al. 2020*
[24] *DBI, 2015, Treibhausgas-Minderungspotentiale in der europäischen Gasinfrastruktur*
[25] *McKibben, Bill, 2016, Global Warming's Terrifying New Chemistry, The Nation, 23.03.2016, available on 10.06.2020 under*

Part of the gas industry has set itself the goal to reduce methane leaks. The members of the Global Methane Alliance, for example, have committed to reducing leakages by 60% by 2025 and by 75% by 2030. Alternatively, members of the Alliance can adopt an intensity target that aims to reduce the leakage rate to 0.25% of total production. Yet, in many parts of the world, there is a lack of independent, regular and verifiable measurements that supervise these actions.[26]

Nevertheless, in recent years the range of measuring instruments that enable more precise detection of leaks has increased. Several satellite projects have the potential to discover methane emissions more effectively than ever.[27] The intensive use of these modern instruments should therefore be sought by all actors to accurately identify and eliminate leaks.

By far the most important measure to reduce methane emissions is to reduce fossil gas consumption, however. If fossil gas is no longer extracted and transported, unintended emissions can be avoided as well.

How does national reporting and measurement work?

Current approach:

At the moment, every state reports all greenhouse gas emissions that occur within its national borders, following the so-called territorial principle. This data is reported annually to the EU Commission and the United Nations Framework Convention on Climate Change (UNFCCC). These “national inventories” are then added together at the European and international level.

In Germany, the Federal Environment Agency (UBA) is responsible for the domestic greenhouse gas inventory. The emissions accounting of the Federal Environment Agency considers also includes methane emissions occurring within German borders. The upstream chain emissions from extraction, production and transport that arise on the way to Germany are not taken into account at all in the reported German emissions from natural gas. However, 95% of German gas demand is covered by imports,[28] meaning that upstream emissions abroad should play a much greater role in the German assessment. The situation is the same for other large gas importers.

Independent measurements:

Methane measurements can be made directly on individual components (e.g. at valves) and then extrapolated to the total number of these components. They can also be carried out at the edge of a production facility on the ground in order to record the emissions of the facility as a whole. In addition, more complex measurements can be carried out with airplanes and satellites. Most of the data, however, are not or only to a small extent based on actual measurements, but rather on statistical data and emission factors. However, these data harbor great uncertainties, as independent measurements from the US show.[29]

The system for measuring and reporting methane emissions must be fundamentally changed and Europe. The emissions must be measured regularly and independently. Projections are not a sufficient basis.

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https://www.thenation.com/article/archive/global-warming-terrifying-new-chemistry/

[26] Climate & Clean Air Coalition, Global Alliance to Significantly Reduce Methane Emissions in the Oil and Gas Sector by 2030, available on 10.06.2020 under https://www.ccacoalition.org/en/activity/global-alliance-significantly-reduce-methane-emissions-oil-and-gas-sector-2030

[27] E.g. Tropospheric Monitoring Instrument (TROPOMI) http://www.tropomi.eu/ and MethaneSAT-Project https://www.methanesat.org/

[28] See BDEW, 2018

[29] See Alvarez et al., 2018

Why is there a need for action now?

Natural gas is a fossil fuel. It is therefore clear that in order to meet European climate targets and respect the principle of climate neutrality, the use of natural gas must be phased out as quickly as possible. However, as long as it is still being used, it is important to do so as efficiently as possible. This means that the methane emissions from the entire value chain must first be correctly identified and then reduced as far as possible. Because methane is short-lived and harmful to the climate, a rapid reduction in methane emissions is particularly important to achieve the climate targets.

The construction of new gas-fired power and heating plants or switching operations from coal to gas should be avoided and investments should be directed into energy efficiency improvements and renewable energy installations instead. If the true emissions factor of natural gas is accurately reflected, it becomes clear that any climate advantage over coal is minimal and that natural gas cannot serve as a 'bridge' or 'transition' fuel.

Policy recommendations

- Natural gas must be treated for what it is: Part of the problem in overcoming the climate crisis. We therefore need a roadmap for a phase-out of natural gas at the European and national levels.
- Any new infrastructure for the import of natural gas such as Nord Stream 2 or the planned LNG terminals needs to be avoided for reasons of climate protection. The issues of methane emissions, which are currently not accurately accounted for, also poses additional stranded asset risks for such infrastructure projects.
- Methane emissions must be measured independently and verifiably everywhere. This applies in particular to the upstream chain emissions in the countries of origin. These measurements are urgently needed:
    - to better understand, predict and reduce emissions,
    - to verify emissions reductions,
    - to assess international sources of supply of fossil gas,
    - to determine the actual greenhouse gas balance of fossil gas.
- Greenhouse gas emissions from natural gas as an energy carrier natural gas must be honestly and accurately accounted for. In assessing its climate impact, methane emissions from the upstream chain must also be taken into account.
- EU Member States must take responsibility and make the measurement and reduction of methane emissions a precondition for gas imports from supplier countries.
- Methane emissions from the gas industry must be regulated at EU level. A voluntary approach is insufficient. One approach would be the introduction of a methane border levy on imports to put a price on methane leakages. Such a levy should be based on conservative estimates of the methane intensity of natural gas intended for import. If confirmed measurements are demonstrably lower than the reference values, a lower levy would apply, creating an incentive for suppliers to address methane leakages. This methane border levy should also apply to imports from non-EU countries.
- The installation of new gas boilers should be banned from 2025 onwards, as this clearly contravenes the objective of reaching a carbon-neutral building stock by 2050.

- Blue hydrogen, which is obtained from natural gas by separating and storing CO_2 (CCS), is a fossil fuel that faces issues of carbon leakage along the process chain. Switching industrial processes or heating to blue hydrogen will not solve the climate problem. Only green hydrogen is free from methane leakages.

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