Methane Emissions from Oil and Gas

Not on track

Tracking report — June 2020

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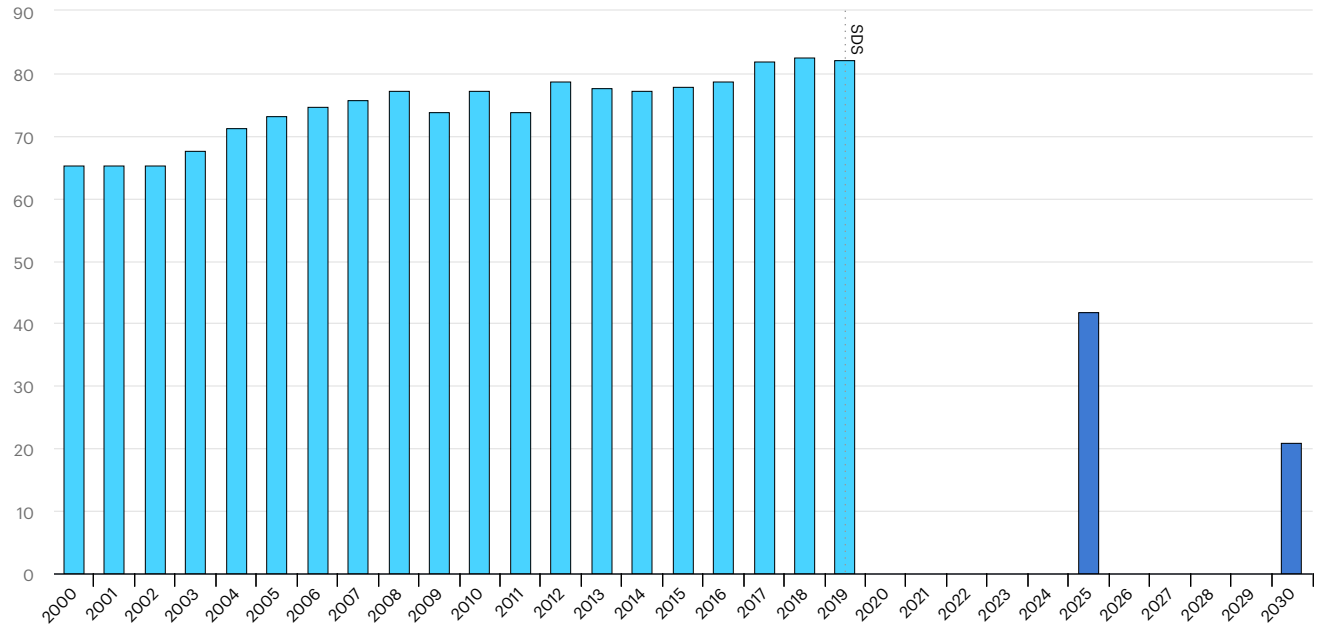
Methane emissions are the second-largest cause of global warming today. Methane emissions come from a range of anthropogenic and natural sources; within the energy sector, from oil, natural gas, coal and bioenergy. The IEA estimates that the oil and gas sector emitted 82 Mt (around 2.5 GtCO2-eq) in 2019. While methane tends to receive less attention than CO2, reducing methane emissions will be critical to avoid the worst effects of climate change. Emissions remain high despite initial industry-led initiatives, government policies and regulations, as implementing abatement options quickly and at scale remains a challenge. Policies will be critical to achieve the 75% emissions reduction by 2030 demonstrated in the SDS, but further innovation and support are needed to better understand emissions levels, make leak detection and repair more consistent, and reduce the overall cost of emissions mitigation programmes.

Oil and gas sector methane emissions 2000-2030 in the Sustainable Development Scenario Open

MtCH4



Despite some efforts from industry and policy-makers to reduce methane emissions from oil and gas operations, an immediate and significant change in ambition is needed to achieve SDS reductions. Although prospects for methane emissions abatement are rising as new aerial and satellite measurements guarantee greater transparency in the oil and gas sector, there is a risk that the drop in oil and gas prices consequent to the 2020 Covid-19 crisis could reduce companies' abilities and willingness to prioritise environmental performance.

The IEA tracks oil and gas methane and provides detailed country-by-country estimates of emissions, abatement technologies, costs and regulation in its Methane Tracker.

Tracking progress

The concentration of methane in the atmosphere is currently around 2.5 times pre-industrial levels and is increasing steadily. This rise has important implications for climate change. Although methane has a much shorter atmospheric lifetime than CO_2 – around 12 years, compared with centuries for CO_2 – it absorbs much more energy while in the atmosphere.

Estimates of methane emissions are subject to a high degree of uncertainty, but the most recent comprehensive estimate suggests that annual global methane emissions are around 570 Mt. This includes emissions from natural sources (40%) and those originating from human activity, also known as anthropogenic emissions, comprise the remaining 60%. [1]

The largest source of anthropogenic methane emissions is agriculture, responsible for one-quarter of the total, followed closely by the energy sector, which includes emissions from coal, oil, natural gas and biofuel combustion.

It is necessary to tackle all sources of methane emissions arising from human activity, but there are important reasons to focus on the oil and gas sector:

- Although coal and bioenergy combustion also release substantial methane emissions, oil and gas operations are likely the largest source in the energy sector.
- Analysis shows clear scope to reduce oil- and gas-related methane emissions cost-effectively. Unlike CO_2, methane – the main component of natural gas – has commercial value, so that any methane captured can often be monetised, and this is typically ier in oil and gas than elsewhere in the energy sector. This means that emissions reductions could result in economic savings or be realised at low cost.

The Covid-19 pandemic could affect oil and gas methane emissions in different ways. Lower oil and gas production could result in a concurrent reduction in leaks, but a decline in revenues from oil and gas operations, as well as low natural gas prices, could also cause companies to pay less attention to the monitoring and maintenance activities needed to tackle methane emissions.

Evaluating emissions trends: Tracking and measurement

Several emerging technologies and approaches to methane detection and measurement are set to provide timely and actionable information on leaks and generally enlarge the amount of data available on oil and gas methane emissions.

Early analytical results suggest satellites are a promising method to conduct global scans to detect and estimate emissions levels from large point sources, and could increasingly be used to provide actionable real-time information to operators. There are also more granular aerial surveillance programmes are being conducted using lower altitude unmanned aerial vehicles including cube sats, planes, helicopters and drones combined with infrared and thermal imaging techniques.

A number of operator-led aerial surveillance programmes are being conducted by companies including ExxonMobil, Royal Dutch Shell, Chevron, Conoco Phillips and BP. Increased stationary surveillance, complemented with routine aerial monitoring, can provide early and widespread detection for methane leaks across operator type 1 and 2 emission sources.

These top-down approaches are also raising awareness of the magnitude of methane emissions. A recent study on the Permian basin based on an assessment from satellite data indicated methane emissions double those detected through bottom-up evaluations.

Researchers are hopeful that greater precision will be obtained with the use of the latest instruments and accompanying methodologies, such as the Environmental Defense Fund's MethaneSat scheduled for launch in 2022. The IEA is monitoring emerging measurement strategies closely and working to integrate results from credible sources into the latest Methane Tracker updates.

Nevertheless, more progress is needed before satellites can generate a comprehensive and reliable global depiction of methane emissions from all oil and gas activities. Challenges persist, such as time delays in converting atmospheric measurements into useful intelligence about surface-level activities, the inability to properly attribute detected emissions to the source, and the difficulty detecting emissions in certain areas (i.e. existing satellites are generally unable to detect emissions over snowy, marshy or offshore areas).

Technology performance

Since methane is a valuable product, and in many cases can be sold if it is captured, it is estimated that around 45% of the 82 Mt of methane emitted today could be avoided with measures that would have no net cost.

A wide variety of generally well-known and well-understood technologies and measures are available to reduce methane emissions from oil and gas operations.

Devices such as vapour recovery units can be installed, while existing devices can be replaced with lower-emitting alternatives such as instrument air systems, no-bleed control and pump systems and electric motors. Leaks from compressors in upstream and midstream assets are a significant source of methane emissions. Emissions can be reduced by improving reliability (uptime), consistent maintenance programs to replace seals, the use of centrifugal compression with dry seals or transitioning to low-emission compression.

One of the most cost-effective mitigation options is leak detection and repair, which is critical to detect and reduce fugitive (or accidental) methane leaks. This is a very dynamic area for technology innovation, and the cost of some of the novel detection methods (including the aerial monitoring and imaging technologies described above) is coming down, however, interpreting extensive datasets for wide spans of onshore developments can be challenging.

Despite these advances, methane emissions from oil and gas operations appear to remain stubbornly high and trends are diverging strongly from the Sustainable Development Scenario (SDS) needs. In the SDS, all technology options are quickly deployed across the entire oil and gas value chains – even if they cannot immediately be paid for through sales of the captured methane – leading to a 75% fall in emissions by 2030.

Industry-led initiatives and policy actions supported by financial investment

Multiple international oil companies (IOCs) have set targets to restrict emissions, or the emissions intensity of production, and many oil and gas industry-led efforts attempt to reduce methane emissions from oil and gas operations.

voluntary, industry-led efforts attempt to reduce methane emissions from oil and gas operations:

- The Methane Guiding Principles (MGP) established in 2017 is a multi-stakeholder collaborative platform incorporating more than 20 institutions from industry, intergovernmental organisations (including the IEA), academia and civil society. The principles aim to advance understanding and best practices to reduce methane emissions, and to develop and implement methane policies and regulations.
- The Oil and Gas Climate Initiative (OGCI) aims to improve methane data collection and to develop and deploy cost-effective methane management technologies; it is made up of 13 major international oil and gas companies. In 2018, OGCI members announced the target of reducing the collective average methane intensity of their aggregated upstream gas and oil operations to below 0.25% by 2025 (from 0.32% in 2017), with the objective of ultimately achieving a level of 0.2%.
- The Oil & Gas Methane Partnership (an initiative of the Climate and Clean Air Coalition) provides protocols for companies to survey and address emissions and a platform for them to demonstrate results. It consists of ten representatives from oil and gas companies, governments, the UN Environment Programme, the World Bank and the Environmental Defence Fund.
- The Environmental Partnership (TEP) is an industry-led voluntary program in the United States that consists of taking action, learning about best practices and technology, and fostering collaboration to reduce emissions. The scope consist of specific actions on leak detection and repair programmes, high bleed pneumatic controllers, and manual liquid unloadings.

However, there are limits to what can be achieved by voluntary action because the pool of those willing to take such action is limited and because the actions themselves may fall short of what is desirable from a public policy perspective. Policies and regulations are therefore essential to align emissions more with the SDS.

Emissions reduction policies are not as ubiquitous as they should be, but some progress has been made:

- Canada has introduced regulations to cut methane emissions 40-45% by 2025 from the 2012 baseline. The provinces of Alberta, British Columbia and Saskatchewan have additional regulatory measures in place to address venting and flaring from upstream oil and gas operations.
- The European Commission is preparing a first-ever strategic plan to reduce methane emissions in the energy sector, with a particular focus on improving measurement, reporting and verification.
- Facilitated by the UN Environment Programme, Nigeria and Côte d'Ivoire announced in January that they would join the Global Methane Alliance. They have committed to increase efforts to reduce methane emissions from oil and gas operations within their borders.

Recommended actions

Quantitative targets set by IOCs to restrict emissions are a welcome first step to help bring this subsector closer to alignment with the SDS.

For companies already claiming low emissions, seeking to continuously reduce emissions is as valuable as quantitative limits; third-party verification and transparency on data and methods are also essential for credible reporting.

However, large volumes of methane are emitted from assets not operated by IOCs. A critical near-term step will be for IOCs to apply their leakage criteria to oil and gas produced from equity assets (joint ventures and non-operated assets).

Along with these voluntary efforts, policies and regulations will be central to methane emissions reductions, and commitments to reduce methane emissions could be an important addition to Paris Agreement NDCs.

Although improving data-gathering and reporting is a key first step, having a lack of detailed information on emissions levels should not preclude the introduction of emissions abatement goals. Policies should concurrently seek to encourage operators to take advantage of abatement opportunities.

Some of the key considerations and principles that could inform methane emissions reduction strategies are set out below. They are likely to be most successful if carried out in stages to help maximise effectiveness and efficiency while shifting emissions trends.

Emphasise data-gathering: Current emission levels are highly uncertain. Raising clarity through direct and consistent measurement is critical to improve understanding of the situation, make it possible to measure progress against goals, and develop and refine objectives and targets. There are large data gaps that need to be filled for numerous major gas-producing and -consuming regions, including Russia and the Middle East.

Set an overall emissions reduction goal: These can be expressed in both broad, qualitative terms and as specific, quantitative and time-bound targets.

Foster innovation and technology deployment: Technological innovations to detect emissions and deliver reliable measurements at low cost is a key technology priority that should be a focus of both public support (at a pre-commercial phase) and private initiatives. Methane management should also be embedded in the oil and gas industry's ongoing digitalisation efforts.

Maximise transparency: Measurement and analysis protocols (including existing datasets) could be shared within the oil and gas industry and among regulators to help ensure consistent quantification and abatement and to spur implementation.

Ensure widespread engagement during the design of regulations: This is important to build support and commitment from as broad a stakeholder group as possible, both in the understanding of emissions and proven abatement options and in the approaches to measurement, reporting and compliance.

Incentivise collaboration: Industry partnerships between national and international oil companies can provide a powerful impetus for the adoption of best practices in regions where policy and regulatory frameworks are less developed. Oilfield service companies, technology firms and auditing firms can also be involved.

Establish adequate enforcement: Devising an effective system entails deciding how oversight and regulation should be carried out, determining an institution responsible for regulation and enforcement, providing leadership and resources for that institution, and establishing meaningful disincentives that support behavioural change, such as penalties for non-compliance.

Incorporate flexibility into measurement and abatement policies: This might be done through various means, including allowing for adjustments to overall goals over time if interim milestones are either exceeded or not met.

Focus on outcomes: In deciding on specific practices, standards, technologies, certification systems and quantitative limits to be introduced, it is important to bear in mind the overarching emissions reduction goal and to focus on the outcomes to be achieved.

Encourage new corporate thinking on methane emissions reductions: While some companies view minimising methane emissions as a central pillar of their operations, others appear to attach much less importance to it.

Explore lower-cost capital investment options for methane reduction technologies: The investment community can stimulate the methane-reduction transition by helping technology companies innovate and deploy new technologies at scale.

Resources

The new methane tracker offers the most comprehensive global overview of methane emissions, covering 8 industry subsectors across more than 70 countries.

IEA Methane Tracker

This IEA commentary describes some of the key insights from the updated methane tracker.

Global methane emissions from oil and gas

This IEA commentary addresses some of the key findings on the environmental case for gas from the World Energy Outlook 2017

Commentary: The environmental case for natural gas

This excerpt from the World Energy Outlook 2017 explores the contours of the new, emerging natural gas order in detail. It examines the opportunities and risks for gas in the transition to a cleaner energy system as well as how the rise of shale gas and LNG are changing the global gas market.

WEO 2017 Special Report: Outlook for Natural Gas

The Methane Guiding Principles were established to address the priority areas for action highlighted in the World Energy Outlook 2017.

Guiding Principles on Reducing Methane Emissions across the Natural Gas Value Chain

OGCI Climate Investments has financed a number of start-up companies aiming to develop low-cost LDAR technologies.

OGCI Climate Investments

References

1 Saunois et al. (2016), "The global methane budget 2000-2012", Earth System Science Data, No. 8, pp. 697-751.

2 Hmiel et al. (2020), Preindustrial $14CH_4$ indicates greater anthropogenic fossil CH_4 emissions, Nature, No. 578, pp. 409-412.

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