iea

Methane Tracker

Report — July 2019

Contents

Cite Share

In this report

Oil and gas producers that can demonstrate that they are taking strong action to reduce methane emissions can credibly argue that their resources should be preferred over higher-emission options. It is crucial for the oil and gas industry to be proactive in limiting, in all ways possible, the environmental impact of oil and gas supply, and for policy makers to recognise this is a pivotal element of global energy transitions.

Overview

Oil and natural gas will be part of the energy system for decades to come – even under ambitious efforts to reduce greenhouse gas emissions in line with the Paris Agreement. As part of today's energy transitions, it is therefore vital to reduce the immediate environmental impacts associated with producing and consuming these fuels. Reducing methane emissions is a powerful and cost-effective way to act, providing an essential complement to action on reducing CO_2.

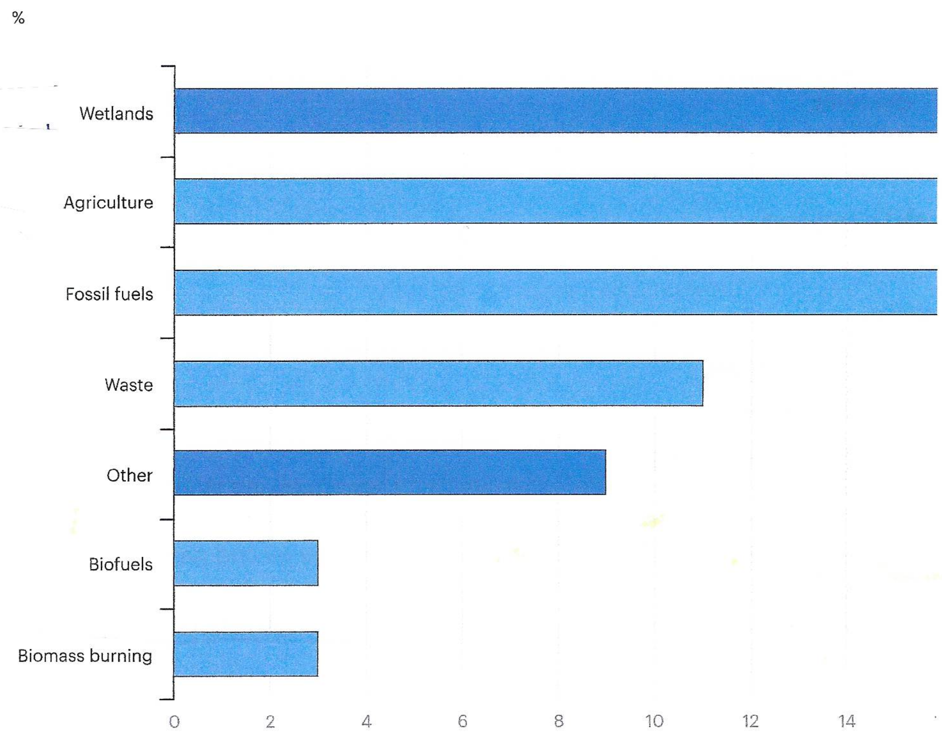
Methane and climate change

The concentration of methane in the atmosphere is currently around two-and-half times greater than pre-industrial levels and is increasing steadily. This rise has important implications for climate change.

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 million tonnes (Mt). This includes emissions from natural sources (around 40% of emissions), and those originating from human activity (the remaining 60% - known as anthropogenic emissions).

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

Sources of methane emissions **Open**



Anthropogenic sources Natural sources

Methane has important implications for climate change, particularly in the near term.

Two key characteristics determine the impact of different greenhouse gases on the climate: the length of time they remain in the atmosphere and their ability to absorb energy. Methane has a much shorter atmospheric lifetime than CO_2 (around 12 years compared with centuries for CO_2) but it is a much more potent greenhouse gas, absorbing much more energy while it exists in the atmosphere.

There are various ways to combine these factors to estimate the effect on global warming; the most common is the global warming potential (GWP). This can be used to express a tonne of a greenhouse-gas emitted in CO_2 equivalent terms, in order to provide a single measure of total greenhouse-gas emissions (in CO_2-eq).

The Intergovernmental Panel on Climate Change (IPCC) has indicated a GWP for methane between 84-87 when considering its impact over a 20-year timeframe (GWP_{20}) and between 28-36 when considering its impact over a 100-year timeframe (GWP_{100}). This means that one tonne of methane can considered to be equivalent to 28 to 36 tonnes of CO_2 if looking at its impact over 100 years.

In addition to its climate impacts, methane also affects air quality because it is an ingredient in the formation of ground level (tropospheric) ozone, a dangerous air pollutant.

Why focus on methane emissions from oil and gas?

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

First, although emissions also come from coal and bioenergy, oil and gas operations are likely the largest source of emissions from the energy sector.

Second, our analysis shows clear scope to reduce them cost-effectively. Unlike CO_2, methane – the main component of natural gas – has commercial value: the additional methane captured can often be monetised directly, and this is typically easier in the oil and gas sectors than elsewhere in the energy sector. This means that emissions reductions could result in economic savings or be carried out at low cost.

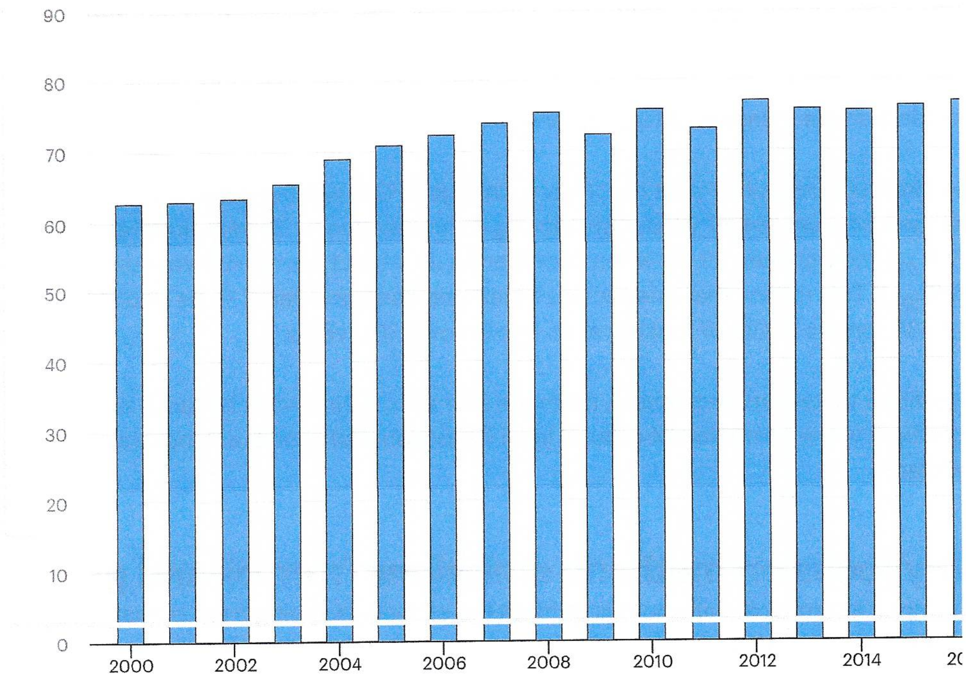
Our scenario projections also suggest that oil and, particularly, natural gas will play important roles in the energy system for decades to come, even under strong decarbonisation scenarios such as the IEA's Sustainable Development Scenario.

Gas can play an important supporting role in energy transitions by replacing more polluting fuels; it may also deliver services that are difficult to provide cost-effectively with low-carbon alternatives, such as peak winter heating, seasonal storage, or high temperature heat for industry. However, fulfilling this role requires that adverse social and environmental impacts are minimised: immediate and major reductions in methane emissions are central to this.

Global methane emissions from oil and gas operations in the Sustainable Development Scenario, 2000-2030

Open

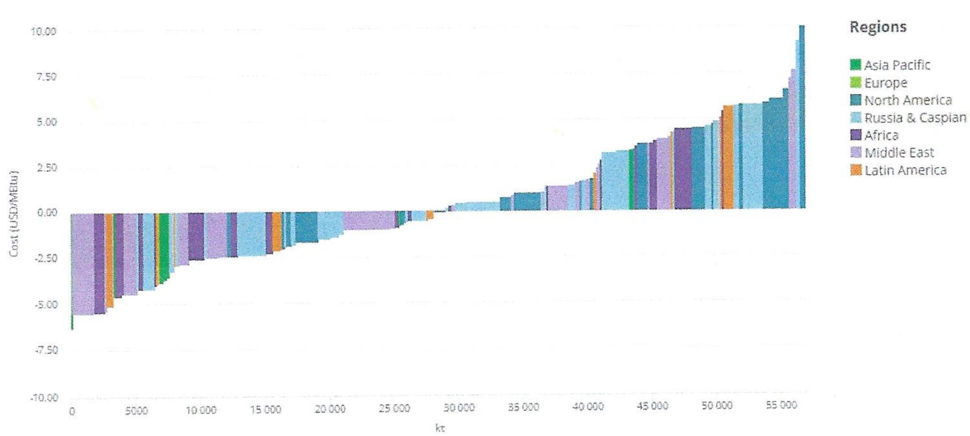
Mt



A compelling case for action

The World Energy Outlook 2017 produced detailed new estimates for methane emissions from oil and gas operations, which form the basis for the detailed data available in this methane tracker. We also developed first-of-a-kind global marginal methane abatement cost curves. These curves describe the reduction potentials as well as the costs and revenues of measures to mitigate methane emissions globally.

Marginal abatement cost curve for oil- and gas-related methane emissions globally



Using this analysis, we estimate that it is technically possible to avoid around three quarters of today's methane emissions from global oil and gas operations. Even more significantly, around 40-50% of current methane emissions could be avoided at no net cost.

If a high share of current emissions can be mitigated using measures that will pay for themselves from the methane recovered, why have these not already been widely adopted?

Possible reasons include:

- a lack of awareness about emission levels or the cost-effectiveness of abatement
- competition for capital within companies with a variety of investment opportunities
- insufficiently quick payback periods to clear the threshold for investment
- the possibility of split incentives (where the owner of the equipment does not directly benefit from reducing leaks or the owner of the gas doesn't see its full value).

The benefit to overcoming these hurdles would be enormous. Implementing only the abatement measures that have positive net present values in the WEO's New Policies Scenario would reduce the temperature rise in 2100 by 0.07 °C compared with a trajectory that has no explicit reductions.

This may not sound like much, but it is immense in climate terms. To yield the same reduction in the temperature rise by reducing CO_2 emissions would require emitting 160 billion fewer tonnes of CO_2 over the rest of the century. This is broadly equivalent to the CO_2 emissions that would be saved by immediately shutting down 60% of the world's coal-fired power plants that are in operation today and replacing them with zero-emissions generation.

Action is also essential in the Sustainable Development Scenario. We incorporate even more stringent reductions in oil and gas methane emissions in this scenario, as failing to do so would require even faster reductions in CO_2. Alongside the rapid declines in CO_2 emissions in the Sustainable Development Scenario, and therefore reductions in fossil-fuel consumption, it remains critical to tackle methane emissions as well.

Next
Methane from oil & gas

iea

Methane Tracker

Report — July 2019

Contents

Cite Share

Methane from oil & gas

Overview

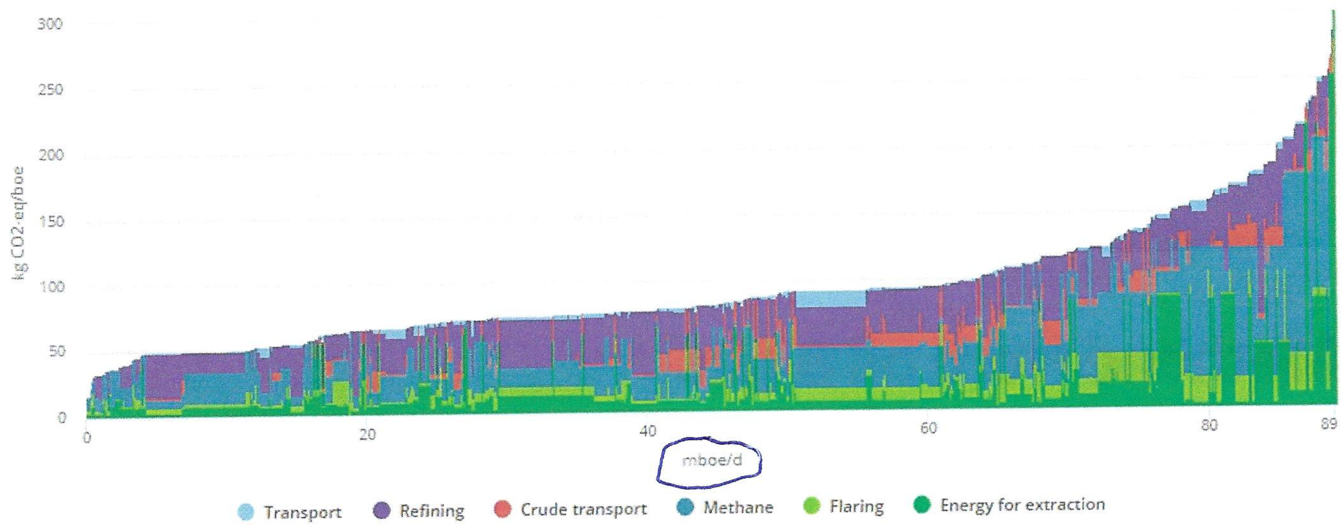
There is very little dispute about the emissions associated with combustion of fossil fuels and the differences between them: CO_2 emissions per unit of energy produced from gas are around 40% lower than coal and around 20% lower than oil. However, there is much less consensus over the indirect emissions on the path from oil or gas production to final consumer, in particular the level of methane emissions that can occur – whether by accident or by design – along the way.

Total indirect greenhouse gas (GHG) emissions from oil and gas operations today are around 5 200 million tonnes (Mt) of carbon-dioxide equivalent (CO2-eq), 15% of total energy sector GHG emissions. Methane, a much more powerful (though shorter-lived) GHG than CO_2, is the largest single component of these indirect emissions.

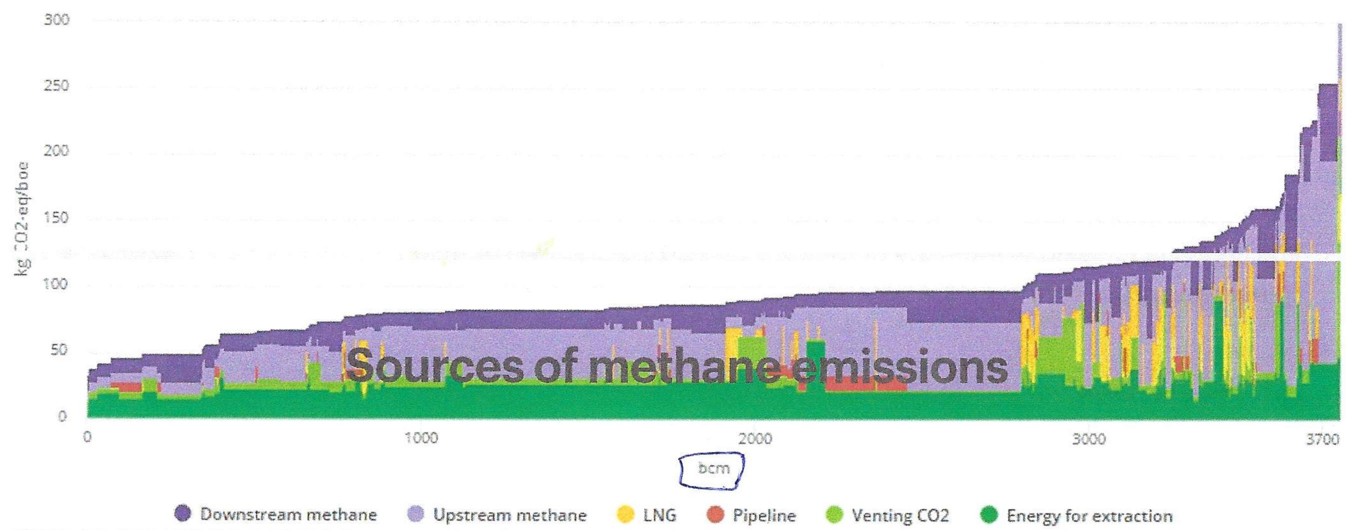
The World Energy Outlook 2018 includes detailed analysis of the indirect emissions associated with producing, processing and transporting the oil and natural gas consumed today.

This analysis highlighted the very broad range in the indirect emissions intensity of different sources of oil and gas. The most-emitting sources of oil and gas produce more than four times the indirect emissions than the least-emitting sources. Indirect emissions from oil are between 10% and 30% of its full lifecycle emissions intensity, while for natural gas they are between 15% and 40%.

Indirect emissions intensity of global oil production, 2017



Indirect emissions intensity of global gas production, 2017



split in roughly equal parts between the two.

These emissions came from a wide variety of sources along the oil and gas value chains, from conventional and unconventional production, from the collection and processing of gas, as well as from its transmission and distribution to end-use consumers. Some emissions are accidental, for example because of a faulty seal or leaking valve, while others are deliberate, often carried out for safety reasons or due to the design of the facility or equipment.

Lifecycle greenhouse-gas emissions: how do gas and coal compare?

The CO_2 emissions from the combustion of natural gas are certainly lower than those from coal. But are they also lower when assessing full lifecycle greenhouse-gas emissions, after taking account of methane emissions released during the supply of the respective fuels?

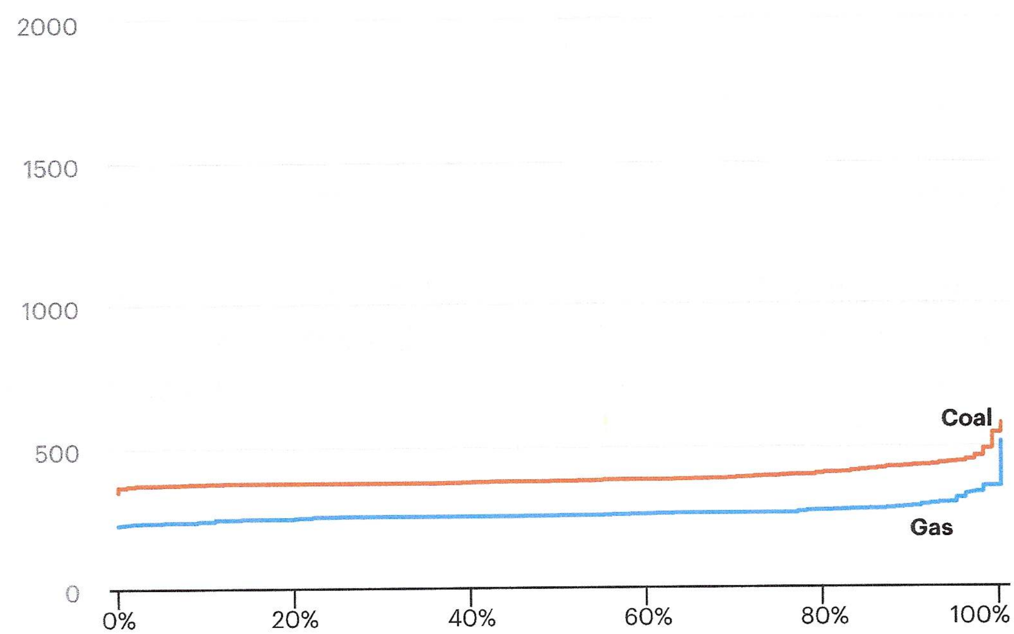
Most of the gas and coal produced today is used for power generation and as a source of heat for industry and buildings.

Our detailed estimates, taking into account both CO_2 and methane, show a wide variation across different sources of coal and gas. Nonetheless, an estimated 98% of gas consumed today has a lower lifecycle emissions intensity than coal when used for power or heat (this comparison excludes any coal use for which gas could not be a reasonable substitute, such as coking coal used in steel production).

This analysis shows that, on average, coal-to-gas switching reduces emissions by 50% when producing electricity and by 33% when providing heat.

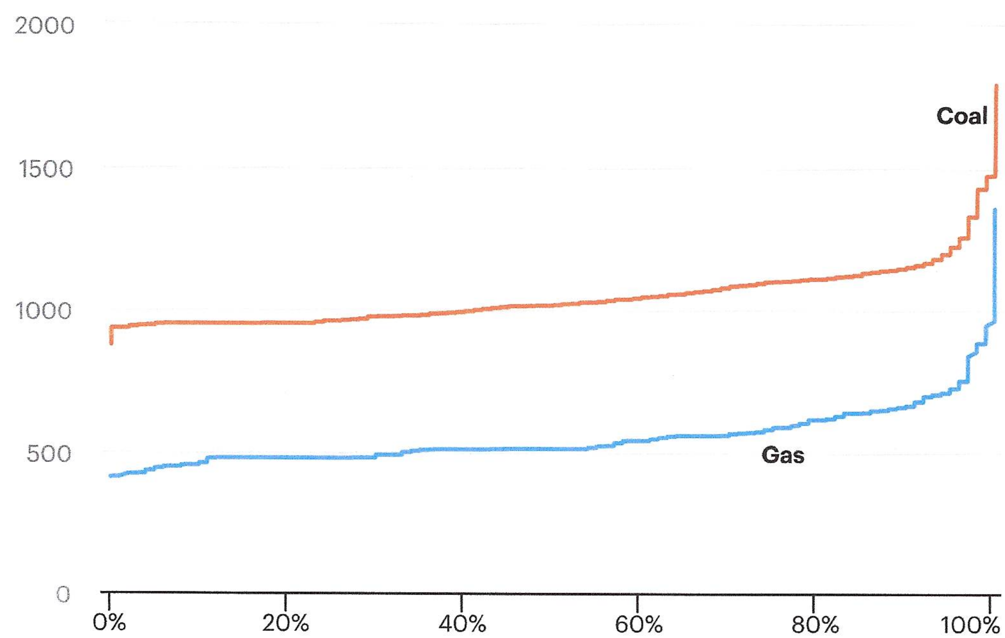
Full lifecycle emissions intensity of global coal and gas supply for heat generation, 2018 **Open**

kg CO2-eq per MWh



Full lifecycle emissions intensity of global coal and gas supply for power generation, 2018 **Open**

kg CO2-eq per MWh



Thi ... es from sw ... ironmental case for ... e most carbon-intensive fuel, but in ensuring that its emissions intensity is as low as practicable.

The longer-term comparison between the fuels also depends on the extent to which emissions are mitigated by large-scale deployment of carbon capture, utilisation and storage technologies.

Next

Methane abatement

The Energy Mix

Keep up to date with our latest news and analysis by subscribing to our regular newsl

Your email Subscribe

Explore our other newsletters

Methane Tracker

Report — July 2019

Methane abatement

Detecting and measuring methane emissions in a comprehensive and cost-effective manner remains a fundamental challenge because of the high cost of detection systems.

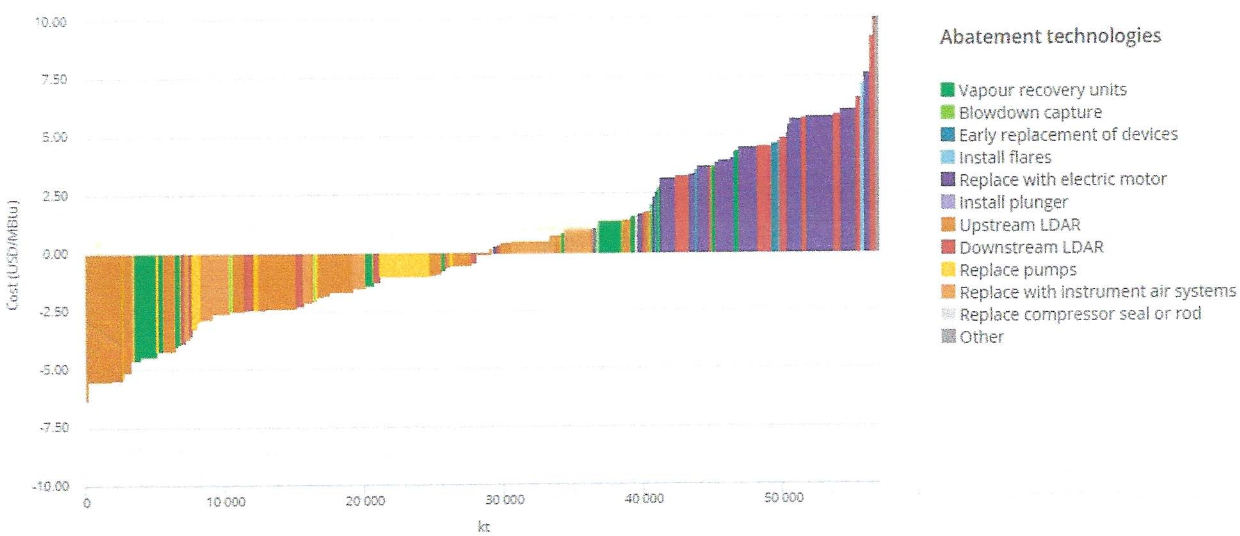
Technologies that can prevent vented and fugitive emissions, by contrast, are reasonably well-known. The challenge is to incentivise the deployment of these abatement technologies via voluntary or regulatory means. In many cases, investment in abatement technologies is economic, as the gas saved quickly pays for the installation of better equipment or the implementation of new operating procedures.

Abatement technologies and costs

If all options were to be deployed across the oil and gas value chains, we estimate that around 75% of these emissions could be avoided. Importantly, since methane is a valuable product and in many cases can be sold if it is captured, we also estimate that around 45% of these emissions could be avoided with measures that would have no net cost (at 2017 natural gas prices).

There is a large degree of variation between countries given different gas prices and capital and labour costs, but the global averages for the key options in the marginal abatement cost curve are shown.

Marginal abatement cost curve for oil- and gas-related methane emissions by mitigation measure, 2018



Explore the interactive version

View abatement curves by country

There are multiple efforts underway to restrict methane emissions or the emissions intensity of oil and gas production. There are also a number of voluntary, industry-led efforts to reduce methane emissions from oil and gas operations:

- The Methane Guiding Principles (MGP) established in 2017 is a multi-stakeholder collaborative platform incorporating over 20 institutions from industry, intergovernmental organisations (including the IEA), academia, and civil society. The principles aim to advance understanding and best practices for methane emissions reduction and to develop and implement methane policy and regulation.
- The Oil and Gas Climate Initiative (OGCI) aims to improve methane data collection and develop and deploy cost-effective methane management technologies; it consists of thirteen major international oil and gas companies. In 2018, OGCI members announced a target to reduce the collective average methane intensity of its aggregated upstream gas and oil operations to below 0.25% by 2025 (from 0.32% today), with an ambition to ultimately achieve 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 group of ten oil and gas companies, governments, UN Environment, World Bank, and the Environmental Defence Fund.

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. Effective targets, policies and regulations established by governments are also therefore essential to bring emissions into line with the trajectory in the Sustainable Development Scenario. The methane tracker provides essential information to help governments and other stakeholders design effective strategies.

Country and regional estimates

The Energy Mix

Keep up to date with our latest news and analysis by subscribing to our regular newsle

Your email Subscribe

Explore our other newsletters