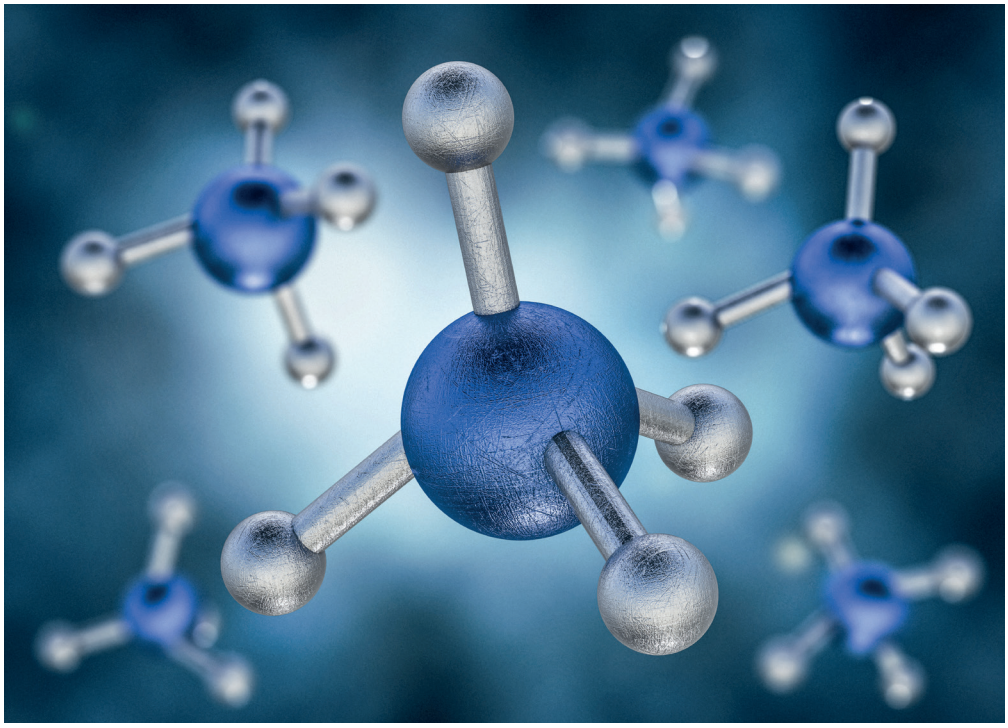
METHANE REDUCTION



Methane mitigation matters

Methane emissions are a serious factor in terms of global warming. Major initiatives are underway across the oil and gas industry to reduce methane emissions significantly, reports *Brian Davis*.

Carbon dioxide (CO_2) emissions are often cited as the main protagonist in terms of greenhouse gases (GHG) and climate change. However, methane has a far more powerful impact. According to the Climate and Clean Air Coalition (CCAC), methane is at least 84 times more potent than CO_2 over a 20-year horizon.

With this in mind, the express objective of the CCAC Oil and Gas Methane Partnership (OGMP) is to help oil and gas companies find, monitor and minimise methane emissions in their operations to create a new global standard in methane emissions control. Set up in September 2014, OGMP partners include BP, Eni, Shell, Statoil, Total, Pemex, Energi, PTT, Neptune Energy and Repsol. Since 2017, the CCAC has been joined by the Environmental Defense Fund (EDF) and the influential Oil and Gas Climate Initiative (OGCI) on peer-reviewed scientific studies to measure methane emissions.

The International Energy Agency (IEA) estimates that upstream oil and gas production accounts for one of five key greenhouse gas mitigation opportunities. It argues that 'relatively low cost reduction measures could account for nearly 15% of total GHG reductions needed by 2020 to keep the world on the 2° C path.' Indeed, the IEA has calculated that the global oil and gas sector could cut 75% of its methane emissions. About half those emissions could be reduced by implementing technical approaches that have 'no net costs', taking into account the value of the gas saved.

Accurate figures on methane emissions are difficult to come by. According to The Global Methane Budget 2000–2012, global oil and gas operations account for about 11% of methane emissions worldwide and 22% of global anthropogenic emissions (originated by human activity). There is a 40:60 split between natural sources of methane emissions (including wetlands and oceanic sources) and anthropogenic sources (including cattle rearing, rice cultivation, fossil fuels, biomass and biofuels). In terms of anthropogenic sources, fossil fuels account for 30–40% of methane emissions – with 30% from coal and the remainder from oil and gas.

The IEA estimates that methane emissions account for 1.8% of global gas extracted. A recent study in *Science* put the scale of methane emissions in the US as accounting for 2.2% of gas extracted.

Application of readily available control technologies and good business practices can reduce pollution significantly. Viable technology solutions are available for addressing many sources of methane emissions, although the economics vary depending on the technical concept and operating conditions.

Major oil and gas producing countries, including Canada, Mexico, Norway and the US, have mandatory regulations for methane emission reduction or mitigation by the oil and gas industry. At COP22, environmental heads of 21 countries agreed to implement policies to minimise oil and gas emissions. Nevertheless, additional reduction is required through enhanced policy activities by governments and oil and gas companies worldwide.

'Over the last few years the sense of urgency and acknowledgment around this issue has massively grown,' says Paul Balcombe, Research Fellow at the Sustainable Gas Institute at Imperial College London. 'But we still have some way to go in terms of understanding the magnitude of these emissions and how much they can be reduced.'

The Intergovernmental Panel on Climate Change (IPCC) suggests that methane is 36 times more potent more potent than CO_2 (in terms of global warming) over a 100-year timeframe, but 84–87 times more potent over a 20-year timeframe.

Further initiatives

The International Petroleum Industry Environmental Conservation Association (IPIECA) is currently undertaking a mapping exercise to determine which institutions are exploring low-emission pathways. The aim is to develop best practice and promote new technology solutions to reduce

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3D rendering of methane (CH_4) molecule

Photo: Shutterstock/Double Brain

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GHG emissions from oil and gas production, refining and transport operations.

The Energy Institute (EI) recently carried out a study, which surveyed opinions on the importance of tackling methane emissions in the oil and gas sector (see **Box**).

The Global Methane Initiative (GMI) involving 38 governments, the European Commission, International American Development Bank and a variety of companies, aims to advance cost-effective methane recovery. A new action plan was adopted in April 2018, with GMI partner countries accounting for about 70% of global man-made methane emissions.

The United Nations Economic Commission for Europe (UNECE) has also introduced a convention to reduce long-range, trans-boundary air pollution. Eight protocols identify specific measures to cut emissions. The Environmental Defense Fund (EDF) has been conducting a five-year study to measure and map oil and gas industry methane emissions, first in the US and now worldwide.

Despite the dramatic growth in shale development in the US, the scale of methane emissions remains uncertain. In fact, methane is emitted across the oil and gas industry supply chain. Upstream emissions are not limited to natural gas wells or fracked wells, but also come from conventional and unconventional oil producing wells. Indeed, inventories tend to underestimate overall emissions. A significant portion of methane emissions are attributed to 'super-emitters', due to mechanical failures and operator error, and are largely absent from emission inventories.

Pressurised tanks for storing methane at a refinery *Photo: Shutterstock/ChiccoDodiFC*

The US Environmental Protection Agency (EPA) estimates that a 2.3% methane leak could erode much of the climate advantage gas has over coal, with lost gas valued at more than $2bn.

'We lack transparent, reliable, robust measurement of methane emissions. There's a lot of emissions measurement in the US, but we lack understanding of regional variations globally,' says Balcombe.

Mitigation technology

There are lots of options for methane emissions mitigation. Balcombe claims one of the best ways to reduce methane emissions is more effective leak detection and remediation (LDAR) methods. 'These are not necessarily high tech, but involve monitoring with infra-red cameras or detection devices to find leaks and repair them,' he says.

Typically, there are emissions from venting equipment, fugitive emissions or incomplete combustion (eg from inefficient flares). Different sources of emissions require different mitigation technologies. 'Processes vary from company to company, and more attention should be paid to fugitive emissions,' says Balcombe.

New legislation in Canada stipulates requirement for an LDAR campaign to reduce methane emissions from oil and gas operations. Methane emissions are believed to be lower in North Sea oil and gas operations due to strong health and safety regulation, rather than specific GHG-related directives. In the US, under the Obama administration an environmental directive was introduced to reduce methane emissions by 40% by 2025. Since then, under the Trump administration there has been a drive to repeal these directives.

The CCAP Oil and Gas Methane Partnership has embarked on a Technology Demonstration Project to determine which methane emission mitigation methods are most effective by partner companies. Nine technologies have been highlighted.

Natural gas-driven pneumatic controllers and pumps vent small amounts of methane, using the back-pressure of the gas to operate the controller. 'Though the systems vent methane by design, problems occur as controllers age,' explains Balcombe. The problem can be solved using low-bleed pneumatic controllers; or intermittent-bleed pneumatic controllers that do not emit when the valve is in the stationary position. Alternatively, pneumatic controls or pumps powered by natural gas can be replaced with those powered by compressed air or electricity. Natural gas-driven pump emissions can also be routed to vapour recovery or a combustion device.

Fugitive component and equipment leaks require a directed inspection and maintenance system.

There are two different types of compressors – centrifugal or reciprocating compressors. Sometimes the seals leak and there are various ways to reduce this.

Centrifugal compressors with 'wet' (oil) seals should be degassed at intermediate pressure and the gas routed to productive use or flared. In some cases, seal oil is degassed at atmospheric pressure and the gas routed to a vapour recovery unit or flare. Alternatively, a mechanical dry seal can be used.

Reciprocating compressors with

EI report highlights issue of methane leakage

Earlier this year the Energy Institute published '*The future of gas*' report*, the first in a new 'EI Views' series which combines opinions from professionals with analysis and commentary from leading industry experts and organisations. It tackles big issues around whether and how natural gas can satisfy both energy security and decarbonisation objectives. The survey-based report also takes a closer look at professionals' perceptions of the risks, opportunities and responsibilities around fugitive methane emissions, and carbon capture and storage.

Addressing methane leakage during production is a vital issue. Many professionals underestimate the significance of fugitive emissions and the possibilities for reducing them cost-effectively. Two thirds of those surveyed expressed surprise at the extent of the problem and these possibilities within their own operations. This lack of awareness around methane suggests a significant opportunity may be missed by the industry within its own operations – an opportunity likely to be quite cost-effective compared with other emissions reduction measures.

*Visit **https://knowledge.energyinst.org/collections/future-of-gas** to download a copy of the report. ●

rod seal/packaging vents require a 'distance piece' or packaging case vents to the atmosphere, with rings replaced about every three years. Rod packaging should be vented to the atmosphere and emissions periodically evaluated for excessive venting. Alternatively, a reciprocating distance piece or rod packaging vents are routed to a vapour recovery unit or flare.

Glycol dehydrators take water out of the gas. Installation of a flash tank separator to the dehydrator directs the gas for more beneficial use via a control device. Alternatively, vents from the dehydrator are routed to a flare, vapour recovery unit or other beneficial use. The dehydrator can also be equipped with an electric circulation pump.

Unstabilised hydrocarbon liquid storage tanks – tank vapours are recovered by routing to a vapour recovery system. Stabilisation towers can be installed ahead of tanks. Alternatively, tank vapours can be routed to a flare/combustion device.

Well venting for liquids unloading – manual liquids unloading can be conducted without atmospheric venting; or a foaming agent can be used to minimise manual liquid unloading; alternatively a plunger lift can be used for liquid unloading without atmospheric venting; or a gas lift used; or liquids can be removed or reduced in the well by using a wellsite compressor.

Well venting/flaring during well completion of hydraulically fractured wells. In the early years of fracking in the US there were quite high methane emissions from the completion process. Now there is good regulation and operators have to install reduced emissions completions (RECs) on fracked wells before production starts. The captured methane is routed towards sales, used as fuel or flared.

Casing head gas venting – compressors can be installed to capture casing head gas. The casing can be connected to tanks with vapour recovery units; or the gas can be flared.

The biggest challenge today is developing more cost-effective detection and monitoring equipment, which can monitor plant continuously, says Balcombe. 'This approach could be highly expensive, so most companies carry out methane emission monitoring campaigns periodically to test for leaks. Continuous monitoring would ensure that plant is repaired in a timely fashion, but the technologies and costs are not there yet.'

Along the supply chain

Methane emissions are a challenge along the supply chain. In the US, the One Future coalition is comprised of leading natural gas companies with operations in oil and gas production, natural gas processing, transmission, storage and distribution. Its ambitious goal is to achieve an average annual methane emission intensity rate across the natural gas value chain equivalent to less than 1% of gross US natural gas production by 2025, using cost-effective abatement methods.

Meanwhile, the Natural Gas Star programme has also moved from a US to global focus on methane emissions reduction.

At the end of last year, eight of the biggest oil and gas companies signed off 'Guiding Principles' to methane emissions reduction along the natural gas value chain. Further oil and gas companies have added to the list, with an action plan scheduled to be released later this year, with input by the EI and Sustainable Gas Institute (SGI). The SGI is also working on projects to understand and reduce the uncertainty around emissions in different parts of the supply chain, and is to produce a report on the role of gas as a fuel in shipping.