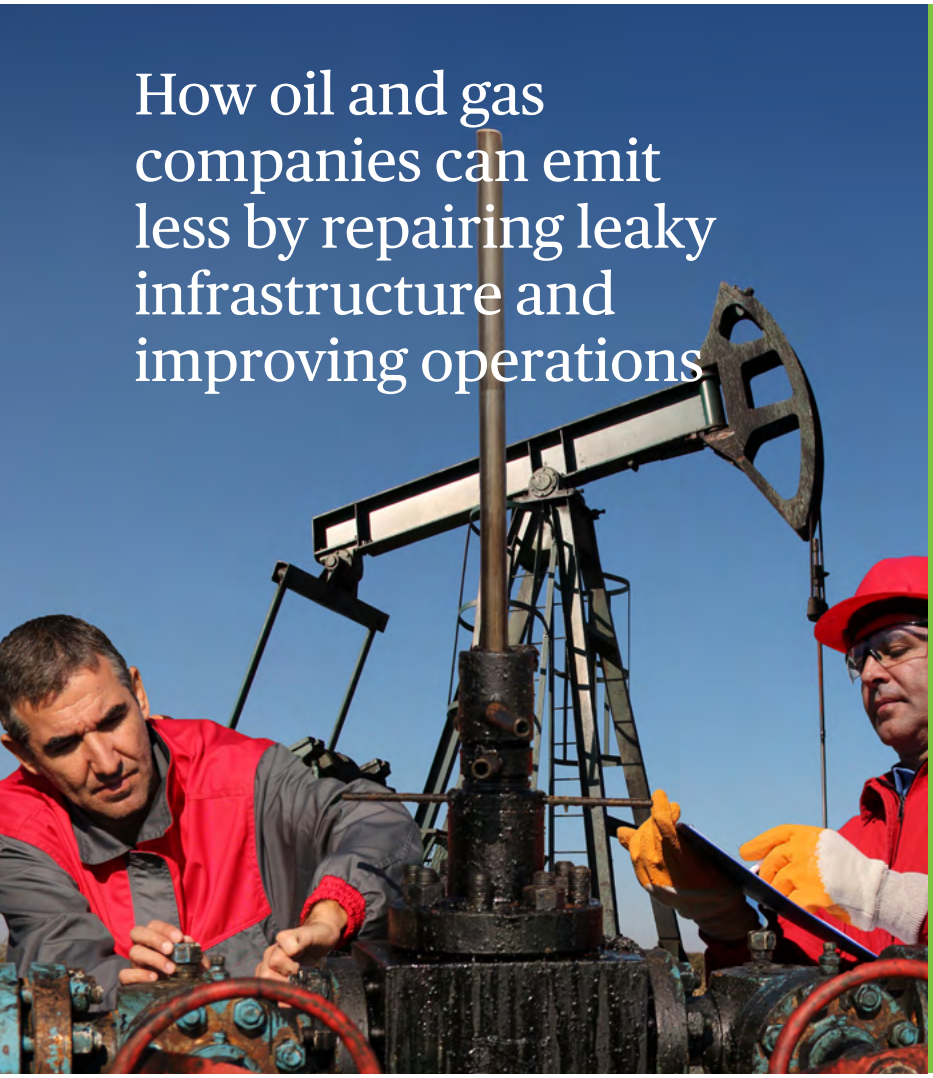
How oil and gas companies can emit less by repairing leaky infrastructure and improving operations



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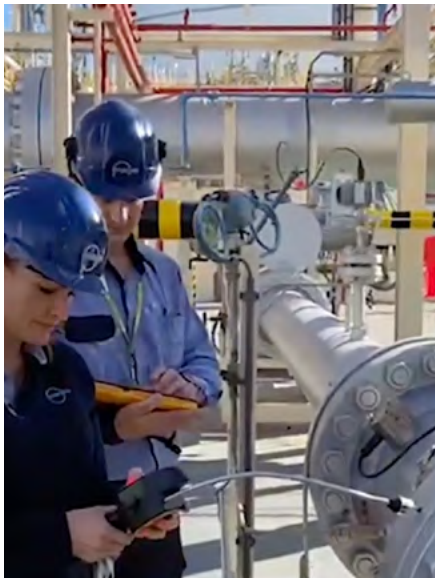
After carbon dioxide, methane is the second-largest greenhouse gas driving climate change. Scientists estimate, in fact, that human-caused methane emissions are responsible for as much as 30 percent of global warming. Because methane is 86 times more potent than carbon dioxide at trapping heat in the earth's atmosphere over a 20-year time span, and also because many of the tools for capturing this gas are already available on the market, it's generally agreed that stopping methane leaks at their source represents one of the most immediate and effective climate strategies we have available to us.

Capturable methane emissions can come from a variety of sources – the agriculture sector and landfills are two notable ones – but more than a third of human-caused emissions can be attributed to the energy sector, where for many years methane leakage was simply considered an unfortunate byproduct of normal operations. While many of the largest energy companies already have sophisticated means for detecting and capturing methane, the task and its associated costs can be more challenging for smaller producers.

Recognizing an opportunity, in June of 2024 the U.S. Environmental Protection Agency (EPA) and U.S. Dept. of Energy jointly announced the release of $850 million in funding for projects that "will help monitor, measure, quantify and reduce methane emissions from the oil and gas sectors." This money, in addition to $350 million in state-specific formula grants that was released in 2023 for reducing emissions from low-producing wells, makes up the bulk of funding under the federal government's new Methane Emissions Reduction Program (MERP), which aims to pair money for methane reduction with compelling incentives, including regulatory incentives, to use that money.



With so many state and federal resources going towards tackling the problem, smaller oil and gas companies now have an opportunity to address their methane emissions with new levels of robustness and support. The first three stated goals of MERP's mission – monitoring, measuring, and quantifying leaks – can be addressed through the deployment of specialized, and increasingly affordable, technologies that have revolutionized the detection process. But that still leaves the fourth goal: reducing. Achieving that goal will require repairing and/or replacing the infrastructure from which fugitive emissions are escaping, as well as rethinking long-held practices such as venting and flaring.

FUGITIVE EMISSIONS: LEAKAGE FROM EQUIPMENT

The EPA has made clear that the financial and technical opportunities made available under MERP are to include, among other forms of assistance, those that "[reduce] methane and other greenhouse gas emissions from petroleum and natural gas systems by improving and deploying equipment." With federal agencies aligning so closely with states to help operators fund and develop strategies for methane mitigation, now is the ideal moment for these operators to double down on identifying the sources of leakage in their facilities that are the result of aged or faulty equipment. Here are some of the equipment components most frequently cited as the source of methane leakage within oil and gas facilities:

Storage tank thief hatches. These closable apertures guard against excessive pressure or vacuum in storage tanks and allow for the periodic sampling of tank contents. Because tank batteries are often located in remote areas, they're not inspected as frequently as other forms of oil and gas infrastructure. If the thief hatch on a tank isn't fully closed and sealed, methane can escape – potentially for long periods of time during which the tank goes unmonitored.

Control valves. These valves allow operators to control rates, pressure and temperature by widening and narrowing the flow passage in a flow system. The part of a control valve known as the valve packing forms the pressure seal between the inside and outside of the valve, which keeps the contents (be they liquid or gas) from escaping. Most fugitive emissions from control valves are a result of valve packing that has worn out or loosened over time.

Pressure relief valves. Also known as pressure safety valves, these are found on compressors, pipelines and other flow infrastructure. They open and shut automatically in order to maintain preset limits for pressure and to avoid overpressure. Though they normally remain closed, when they do open – as in the case of overpressure – the valve releases gas directly into the air (a form of venting). But even when closed, the O-rings and bolts of valve seals are subject to normal wear and tear and corrosion over time. Dirt and debris can also gather on the seal and compromise its efficacy, resulting in leaks.

Well casings. Inside each wellbore drilled into the ground is a steel production tube that is surrounded by casings, which are often made from high-strength steel. These casings are in turn surrounded by a layer of cement, which is designed to seal the gap between the casings and the wellbore – but tiny impairments in the casings and the cement can result in methane leakage at the surface.

Connectors, flanges, couplings and fittings. The various pieces that join individual units of piping or other process equipment to one another are frequent sources of fugitive emissions. Most leaks that come from these junctures are a result of worn-out gaskets or bolts that have not been properly torqued.

CONTROLLED EMISSIONS: FLARING AND VENTING

Routine flaring can result in the release of dangerous air pollutants, including nitrogen dioxide, fine particulate matter and others.

For many years, heavy-liquids-producing operators have been flaring or venting associated natural gas, which is the gas produced alongside crude oil and typically separated at the wellhead. Flaring involves igniting this gas, which converts the methane into carbon dioxide – a greenhouse gas less potent than methane, but one that is nevertheless acknowledged as the chief source of the global warming that drives climate change. Operators sometimes flare natural gas for safety reasons or during maintenance, but in other instances gas is flared because of insufficient infrastructure that is required to transport the gas to processing centers. But there are also environmental and public health costs to consider: In addition to introducing more carbon dioxide to the atmosphere, routine flaring can result in the release of dangerous air pollutants, including nitrogen dioxide, fine particulate matter and others. And even though flaring is designed to keep methane from entering the atmosphere, inefficiencies in flaring systems mean that significant amounts frequently escape, unignited, from facilities.

In May of 2024, the U.S. Department of Energy announced that it would be releasing $32 million in funding to a suite of four research and development projects aimed at helping oil production sites reduce flaring "by transforming gas into valuable products that would otherwise be wasted by those operations." The projects being funded represent the cutting edge in technologies designed to supplant flaring as the default means of gas disposal at these sites. One involves the development of a small, modular plant that can be installed onsite and that is capable of converting associated gas that would normally be flared into methanol, a simple alcohol with a variety of industrial applications. Another involves developing and testing a high-energy porous heat exchanger that can be deployed at well sites to convert gas into electricity through oxidization. If successfully implemented and brought to scale, innovative technologies such as these may change the economic calculus for well operators and encourage them to capture, rather than burn, the associated gas they generate.

Like flaring, venting is typically a controlled process that is used to dispose of associated gas, except that in this case the gas is not ignited. Venting can take place at many different points throughout production; often it occurs as a means of relieving excess pressure in a system as large amounts of gas move through pipelines or other equipment such as storage tanks, compressors and dehydrators. A 2023 study of oil facilities in Alberta, Canada – that country's largest oil- and gas-producing province – found that two thirds of the industry's upstream methane emissions could be attributed to venting. Because venting releases quantities of unignited methane directly into the atmosphere, its short-term climate impact is greater than that of flaring.

In addition to its climate benefits, capturing methane that might otherwise be flared or vented represents a potential economic opportunity for oil and gas operators. The United States flared or vented more than 270 billion cubic feet of natural gas in 2022; with the average price of natural gas hovering around $7.80 per thousand cubic feet for that year, the market value of all of that wasted gas was more than $2 billion.

EXPLORING SOLUTIONS

Methane leaks are inevitable in any oil or gas operation. Thermal stress, mechanical stress, improper installation, insufficient observation or maintenance and ordinary wear-and-tear are just some of the reasons for fugitive emissions at facilities. Fortunately, developments in methane detection technology now allow operators to identify leaks, even the smallest ones, in ways that simply weren't possible a generation ago. And studies show that repairing leaks and recovering methane almost always makes economic sense – even when gas prices are relatively low.

Increasingly, more and more operators are realizing that venting and flaring also represent a wasted opportunity to retain marketable natural gas while reducing planet-warming methane and benefitting the health of employees and local communities. Chubb's Methane Resource Hub contains a variety of resources aimed at helping energy companies mitigate their methane emissions, including videos that share best practices for reducing emissions from flaring and venting as well as a detailed guide to developing a leak detection and repair (LDAR) program – a comprehensive system for identifying and repairing leaks that reduces operators' risks by helping them minimize their environmental impact, comply with regulatory requirements and optimize operational efficiency and product recovery. Consult this guide for more information on the ways that Chubb is working with clients in the oil and gas industry to reduce their methane emissions, bring them into compliance with new regulations and save them money.