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SUSTAINABILITY

Leaky Methane Makes Natural Gas Bad for Global Warming

If leaks continue at present rates, natural gas may not help combat climate change

By Gayathri Vaidyanathan, ClimateWire on June 26, 2014

Scientists who have measured methane emissions over gas fields in the Uinta Basin of Utah say emissions are close to 9 percent. U.S. EPA suggests a leakage rate of 1.2 percent - equal to the annual emissions of 112 million cars. *Credit: Joshua Doubek via Wikimedia Commons*

Natural gas fields globally may be leaking enough methane, a potent greenhouse gas, to make the fuel as polluting as coal for the climate over the next few decades, according to a pair of studies published last week.

An even worse finding for the United States in terms of greenhouse gases is that some of its oil and gas fields are emitting more methane than the industry does, on average, in the rest of the world, the research suggests.

"I would have thought that emissions in the U.S. should be relatively low compared to the global average," said Stefan Schwietzke, a researcher at the National Oceanic and Atmospheric Administration's Earth Systems Research Laboratory in Boulder, Colo., and

lead author of the studies. "It is an industrialized country, probably using good technology, so why are emissions so high?"

The natural gas industry globally was leaking between 2 and 4 percent of the gas produced between 2006 and 2011, the studies found. Leakage above 3 percent is enough to negate the climate benefits of natural gas over coal, so the findings indicate there is probably room for the industry to lower emissions.

The studies were published in the journals *Environmental Science & Technology* and *ACS Sustainable Chemistry and Engineering*.

Leakage equal to the emissions of 112M cars?

The insights go to the heart of the debate surrounding the use of natural gas in the United States today. The nation is in an oil and gas boom due to technological advances that have unlocked vast new reserves and vaulted the nation beyond energy behemoths like Russia and Saudi Arabia.

The Obama administration has supported the natural gas industry, in part for the fuel's climate benefits. Gas emits about half as much carbon dioxide as coal in the power plant, so the government has promoted gas as a transition fuel to a post-carbon future.

The fine print, however, is that natural gas may be as detrimental to the climate as coal in many ways. Its climate challenge lies not during electricity generation, but further upstream—during extraction, processing and distribution of gas from the oil and gas wells to gas burners.

From wellheads, pipes, valves, compressors and various other equipment, gas wells leak raw methane, a greenhouse gas that is 86 times as potent as carbon dioxide over a 20-year time scale, according to the Intergovernmental Panel on Climate Change. While CO2 persists in the atmosphere for centuries, wreaking climate havoc slowly, methane works more rapidly for a short while before decaying into less virulent gases. For the climate equation, both CO2 and methane emissions matter, scientists say.

So far, no one—not industry, academia or government—has a good grasp on how much methane is leaking from natural gas production. Scientists have been racing to find out, but the fact-finding process has been slow, partially because of the relative opacity of the industry.

The natural gas industry says its emissions are close to zero. It also maintains that regulations are unnecessary to cut down on leaks, as companies have an economic incentive to capture methane. "The industry has led efforts to reduce emissions of methane by developing new technologies and equipment," Howard Feldman, director of regulatory and scientific affairs at the American Petroleum Institute, said earlier this year.

Scientists who have measured methane emissions over gas fields in the Uinta Basin of Utah say emissions are close to 9 percent (*ClimateWire*, Aug. 7, 2013). U.S. EPA suggests a leakage rate of 1.2 percent—equal to the annual emissions of 112 million cars.

Schwietzke's studies jump into the fray with a more global perspective.

Revamping an inventory

NOAA scientists sometimes go down to the Port in Los Angeles and attach air monitors to ships that can measure the levels of methane, CO2, ethane and other gases in the atmosphere. These are part of NOAA's network of monitoring sites, composed of ships, aircraft and tall towers sprinkled throughout the world, from the depths of the Amazon to frigid Antarctica.

Over the past two decades, the network has measured an average 550 teragrams of methane emitted to the atmosphere per year. The gas is emitted by wetlands (plants decaying in swamps emit the gas), rice fields, animals, the burning of wood or biomass, and oil and gas fields. The researchers wanted to figure out how much of the total methane was emitted by the natural gas industry.

Their task was complicated because natural gas, oil and coal are all roughly similar. Extraction of all three releases similar byproducts—methane and ethane, among others—to the atmosphere, albeit in different quantities.

So Schwietzke used inventories from EPA, the IPCC and other sources to estimate oil field and coal emissions. This partitioning had been done previously, but Schwietzke redid the inventory, driven by the understanding that all scientific findings are plagued by uncertainty. The previous inventories partitioning oil and coal had not stated how certain they were in their results.

Schwietzke found this problematic, since EPA and other inventories are known to be somewhat fallible (*EnergyWire*, Feb. 24).

Once he had his uncertainties, Schwietzke input his oil and coal numbers into a computer model. He also input methane emissions from wetlands, landfills, biomass burning and agriculture, all derived from previous scientific studies. The only missing link was emissions from the natural gas industry.

The computer model subtracted the range of emissions Schwietzke input from the real-world NOAA measurement of methane in the atmosphere. Its output was the average global methane leakage from the natural gas industry. This was at most 5 percent of global annual natural gas production.

High Utah rates not the norm

To further refine his results, Schwietzke input the data into a more complicated three-dimensional atmospheric model. This model further constrained the global average emissions rate of methane to 2 to 4 percent.

Using real-world global data, his models suggest that natural gas producers are leaking to the atmosphere, on average, between 2 and 4 percent of the natural gas they produce.

That is enough to negate the climate benefits of gas over coal in the next two decades, the studies find. Various life-cycle analyses have found that in order for gas to be better than coal for the climate, the methane leakage rate has to be less than 3 percent. That overlaps the leakage found by Schwietzke.

Schwietzke's studies also suggest that the highest emissions rates in literature, such as the 9 percent recorded in the Uinta Basin of Utah, are not the norm across the United States. These fields deviate very significantly from the global norm, and likely from the national norm, Schwietzke said. He expressed surprise that such fields could occur in a technologically advanced nation like the United States.

"It could be that the industry practices they use in this basin are really bad," he said.

ABOUT THE AUTHOR(S)

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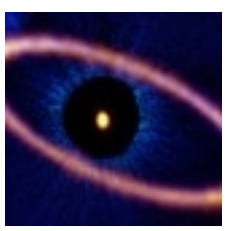

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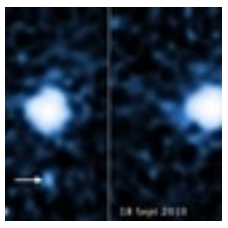

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