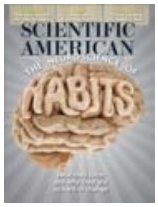
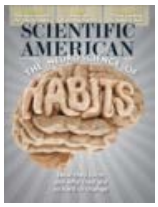




Leaky Methane Makes Natural Gas Bad for Global Warming

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

ClimateWire

Jun 26, 2014 | By Gayathri Vaidyanathan and ClimateWire

More from Scientific American

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

Latest News
Most Read
Environmental Crime Funds Terrorism
Sneezes Travel Even Farther Than We Thought
Psychotropic Drugs Affect Men and Women Differently
Blind Mice Cured by Running
Creative Spark: Neuroscientist-Turned-Artist Shares His Process
Think Twice: How the Gut's "Second Brain" Influences Mood and Well-Being - Scientific American
Why do cats purr? - Scientific American
Are You Afraid of Holes? - Scientific American
Strange but True: Drinking Too Much Water Can Kill - Scientific American
Follow Us:

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.

Share this Article:

Comments

Oldest - Newest

kebowers47 June 26, 2014, 2:17 PM
I find the conclusions incredible. I do seriously question the validity of the 'data' collected from/about all the other sources--like human flatulence, cattle, grass lands, etc. The potential for orders of magnitude errors is significant.
One 'overlooked' source is 'coal bed methane', released during mining operations but uncounted. Vast areas of lignite contain lots of methane at shallow depths. Those very large deposits are all 'leaking' to some degree. This leakage is actually used in detecting underground concentration (gas fields).
Oil and gas production activities impact a miniscule fraction of the total surface area, and very few have any measurable gas leakage to the environment. Some in the middle-east and Africa just directly vent co-produced gas rather than contain and re-inject it.
Report as Abuse |
Link to This

singing flea June 26, 2014, 2:44 PM
Quote, "That is enough to negate the climate benefits of gas over coal in the next two decades, the studies find."
Both the production and burning of natural gas and coal is increasing the greenhouse effect in the atmosphere. To insinuate that one has a benefit over the other in the first place is just plain irresponsible. It's like saying filtered cigarettes are safer than non filtered cigarettes.
The fact is there is no climate benefit using either one for fuel and if it really was beneficial the industry would be bending over backwards to show scientific proof. At its best the switch from coal to NG is just the better of two evils when it come to climate change, but that has yet to be proven due to industry obfuscation of the data.
The major advantage of burning natural gas instead of coal is the lower amounts of other toxic chemicals released with burning coal and the huge difference in energy expense to extract and transport coal vs. natural gas.
Report as Abuse |
Link to This

Goldenboys June 26, 2014, 5:34 PM
AP 4-28-2013. The EPA has dramatically lowered its estimate of how much of a potent, heat trapping gas (methane) leaks during natural gas production, in a shift with major implications for debate that has divided environmentalists. (These findings were based on a 16 month study.) in February 2014, in the face of withering criticism by Global Warming aficionados, the EPA REAFFIRMED its finding based on additional study that, indeed, Methane released by fracking continues to be MUCH LESS than originally thought. In fact, the EPA placed Cow Flatulence as the #1 cause of free Methane world-wide.
Report as Abuse |
Link to This

jtdwyer June 26, 2014, 6:07 PM
As best I could find, there's only one research report - published in two journals(!?)
"Natural gas fugitive emissions rates constrained by global atmospheric methane and ethane" - http://www.dx.doi.org/10.1021/es501204c - it seems to be freely available, but you must register with the journal(!?)
Report as Abuse |
Link to This

singing flea Goldenboys June 26, 2014, 8:33 PM
What difference does it make? The fact is that there has always been natural sources of methane, CO2 and other green house gases. It is the natural balance that has kept Earth the paradise it is in the solar system. It is the

rapid upsetting of that balance that concerns environmental scientists. Unless other changes are made to sequester green house gases that are released by mankind, we will get ever closer to conditions on Venus. If these changes do in fact cause a runaway effect due to the release of trapped methane hydrates in the polar regions we may just find ourselves in a heap of trouble much faster than we think.
Report as Abuse |
Link to This
SAULT18 Goldenboys June 27, 2014, 10:14 AM
That study was rigged. It only shows that methane emissions CAN be very low if the drillers know inspectors are coming AND they use industry best-practices to minimize leakage. In practice, since these measures lower profit margins, it is less likely for them to be put into place.
Report as Abuse |
Link to This
Bremsstrahlung June 28, 2014, 2:08 PM
'That study was rigged'
What evidence can you show that it was rigged? Are you suggesting the EPA is corrupt?
Report as Abuse |
Link to This
Bremsstrahlung singing flea June 28, 2014, 2:12 PM
'The major advantage of burning natural gas instead of coal is the lower amounts of other toxic chemicals released with burning coal and the huge difference in energy expense to extract and transport coal vs. natural gas.'
Both are good reasons to continue the transition from coal to NG.
The first reason is that doing so reduces air pollution, and everyone benefits from that. The second helps minimize the cost of producing energy, and the poor benefit from that.
Report as Abuse |
Link to This
benwelgoed kebowers47 June 29, 2014, 10:16 AM
k..47, Likewise, it's totally incredible that all living beings on this planet, aaalllll of them are configured in agreement with a minute amount of matter called DNA, and so, that must be false as well by your reasoning. Wake up to reality please.
Report as Abuse |
Link to This
You must sign in or register as a ScientificAmerican.com member to submit a comment.

Deadline: Aug 26 2014
Reward: **See Details**
Investors are flooded every day by thousands of news items from many different sources – blogs, feeds, internal reports, news services –
More Challenges »

Powered By: INNOCENTIVE

Latest from SA Blog Network

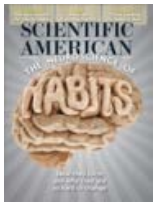
A suggestion for those arguing about the causal explanation for fewer women in science and engineering fields. Doing Good Science | 49 minutes ago
The Future Belongs to Women Scientists and CEOs STAFF Observations | 2 hours ago
Pinch of Pigment: Quinacradone Burnt Orange Symbiartic | 4 hours ago
Arctic creepy-crawlies part II: woolly bear caterpillars Lab Rat | 5 hours ago
How To Pick A Photoshopped Firefly Compound Eye | 22 hours ago

News From Our Partners

REUTERS
Newly Discovered Mouse-like Mammal Is Closely Related to Elephants
nature
Blind Mice Cured by Running
tech media network
One Fifth of U.K. Kids with Persistent Coughs May Have Pertussis
ClimateWire
Tiny Electric Grids Help States Weather Extreme Storms

Science Jobs of the Week

Research Scientist / Staff Scientist (Soft X-ray Optics Development and Implementation) Lawrence Berkeley National Laboratory (LBNL)
PhD Student in Immunology & Hemostaseology University Medical Center Mainz, Center for Thrombosis and Hemostasis (CTH)
Biosciences Strategic Business Analyst Lawrence Berkeley National Laboratory (LBNL)
More jobs from Naturejobs.com »



Advertise
Special Ad Sections
SA Custom Media and Partnerships
Science Jobs
Partner Network
International Editions
Travel
About Scientific American
Press Room
Site Map
Terms of Use
Privacy Policy
Subscribe
Use of Cookies
Renew Your Print Subscription
Print Subscriber Customer Service
Buy Back Issues
FAQs
Contact Us