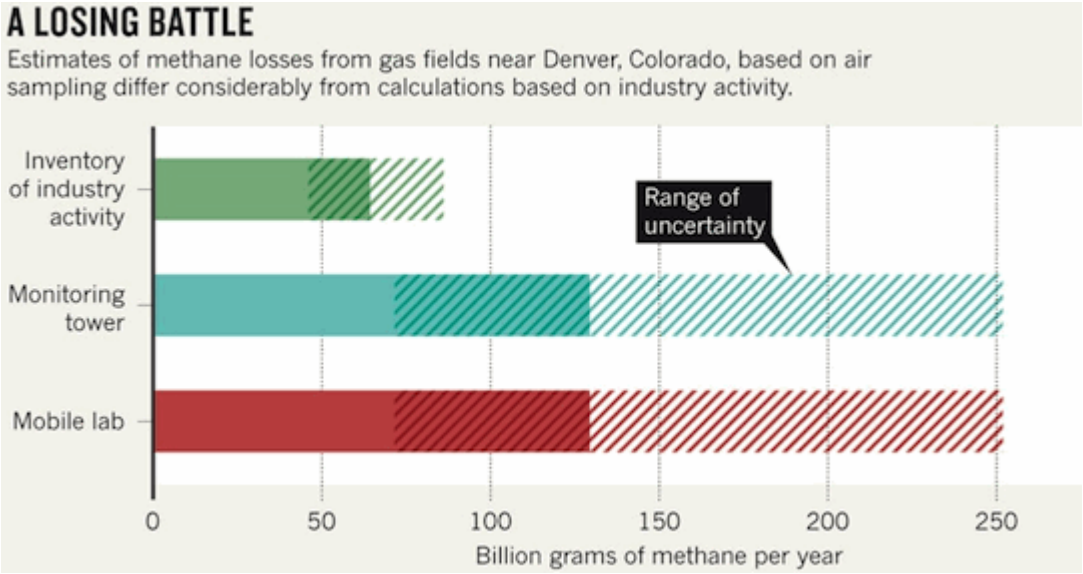
Bombshell Study: High Methane Emissions Measured Over Gas Field "May Offset Climate Benefits of Natural Gas"

By **Joe Romm** on Feb 8, 2012 at 6:29 pm

Air sampling by NOAA over Colorado Finds 4% Methane Leakage, More Than Double Industry Claims



Natural-gas operations could release far more methane into the atmosphere than previously thought. [Source: Nature]

How much methane leaks during the entire lifecycle of unconventional gas has emerged as a key question in the fracking debate. Natural gas is mostly methane (CH4). And methane is a far more

potent greenhouse gas than (CO2), which is released when any hydrocarbon, like natural gas, is burned.

Even without a high-leakage rate for shale gas, we know that "Absent a Serious Price for Global Warming Pollution, Natural Gas Is A Bridge To Nowhere."

But the leakage rate does matter. A major 2011 study by Tom Wigley of the Center for Atmospheric Research (NCAR) concluded:

The most important result, however, in accord with the above authors, is that, unless leakage rates for new methane can be kept below 2%, substituting gas for coal is not an effective means for reducing the magnitude of future climate change.

The industry has tended kept most of the data secret while downplaying the leakage issue. Yet I know of no independent analysis that finds a rate below 2%, including one by the National Energy Technology Laboratory, the DOE's premier fossil fuel lab.

Now, as the journal *Nature* reports, we finally have some actual air sampling measurements, and they appear to confirm the higher estimates put forward by Cornell professor Robert Howarth:

When US government scientists began sampling the air from a tower north of Denver, Colorado, they expected urban smog — but not strong whiffs of what looked like natural gas. They eventually linked the mysterious pollution to a nearby natural-gas field, and their investigation has now produced the first hard evidence that the cleanest-burning fossil fuel might not be much better than coal when it comes to climate change.

Led by researchers at the National Oceanic and Atmospheric Administration (NOAA) and the University of Colorado, Boulder, the **study estimates that natural-gas producers in an area known as the Denver-Julesburg Basin are losing about 4% of their gas to the atmosphere — not including additional losses in the pipeline and distribution system. This is more than double the official inventory, but roughly in line with estimates made in 2011 that have been challenged by industry**. And because methane is some 25 times more efficient than carbon dioxide at trapping heat in the atmosphere, releases of that magnitude could effectively offset the environmental edge that natural gas is said to enjoy over other fossil fuels.

Methane is 25 times more efficient than CO2 trapping heat over 100 year — but it is 100 times more efficient than CO2 trapping heat over two decades.

"If we want natural gas to be the cleanest fossil fuel source, methane emissions have to be reduced," says Gabrielle Pétron, an atmospheric scientist at NOAA and at the University of Colorado in Boulder, and first author on the study, currently in press at the *Journal of Geophysical Research*. Emissions will vary depending on the site, but Pétron sees no reason to think that this particular basin is unique. "I think we seriously need to look at natural-gas operations on the national scale."

UPDATE: The 30-author study, led by NOAA researchers, "Hydrocarbon emissions characterization in the Colorado Front Range – A pilot study" is online here (subs. req'd).

Natural gas emits about half as much carbon dioxide as coal per unit of energy when burned, but separate teams at Cornell University in Ithaca, New York, and at the US Environmental Protection Agency (EPA) concluded last year that methane emissions from shale gas are much larger than previously thought. The industry and some academics branded those findings as exaggerated, but the debate has been marked by a scarcity of hard data.

"It's great to get some actual numbers from the field," says Robert Howarth, a Cornell researcher whose team raised concerns about methane emissions from shale-gas drilling in a pair of papers, one published in April last year and another last month (R. W. Howarth *et al. Clim. Change Lett*. **106,** 679–690; 2011; R. W. Howarth *et al. Clim. Change* in the press). "I'm not looking for vindication here, but [the NOAA] numbers are coming in very close to ours, maybe a little higher," he says.

Natural gas might still have an advantage over coal when burned to create electricity, because gas-fired power plants tend to be newer and far more efficient than older facilities that provide the bulk of the country's coal-fired generation. But only 30% of US gas is used to produce electricity, Howarth says, with much of the rest being used for heating, for which there is no such advantage.

Late last year, some of the leading (center-right) economists in the country — Nicholas Z. Muller, Robert Mendelsohn, and William Nordhaus — concluded in a top economic journal that **the total damages from natural gas generation exceed its value-added at a low-ball carbon price of $27 per ton!** At a price of $65 a ton of carbon, the total damages from natural gas are more than double its value-added!

For the record, stabilizing at 550 ppm atmospheric concentrations of CO2, which would likely still be catastrophic for humanity, would require a price of $330 a metric ton of carbon in 2030, the International Energy Agency (IEA) noted back in 2008. So even leak-free, new gas generation isn't a good investment if avoiding catastrophic warming is your goal.

Back in April, I wrote about Howarth's controversial paper, "New study questions shale gas as a bridge fuel," arguing:

This is a potentially game-unchanging conclusion for one of the seminal energy policy choices of this decade — how hard to push shale gas here and around the world. And yet, as the lead author Cornell Prof. Robert Howarth explained to me in an interview, it is based upon very limited data. And that's in part because the industry has fought efforts to get more data. Prof. Howarth agreed with my suggestion that **this would be a very ripe topic for the National Academy of Sciences to review.**

Howarth's analysis does in fact appear to be vindicated by these real-world observations. I asked him for comment. He writes of the *Nature* piece:

As they point out, our estimates seem to be a little on the low side. That's not surprising, as we were pretty conservative in our published analysis. This new paper has the first actual measurements at the landscape scale, which is exactly what has been needed (as we concluded in our first and second papers).

In truth, it would not have surprised me if their numbers had come out either considerably higher than or considerably lower than ours, but it is quite gratifying to see that they basically confirm our estimates, and suggest in fact that the greenhouse gas emissions are even somewhat worse than we had concluded. This is bad news for the planet, but good news for our credibility.

He directed me to an online version of his new 2012 paper, which concludes:

We reiterate our conclusion from our April 2011 paper that shale gas is not a suitable bridge fuel for the 21st Century.

The fact that natural gas is a bridge fuel to nowhere was also demonstrated by the International Energy Agency in its big June 2011 report on gas — see IEA's "Golden Age of Gas Scenario" Leads to More Than 6°F Warming and Out-of-Control Climate Change. That study — which had both coal and oil consumption peaking in 2020 — made abundantly clear that if we want to avoid catastrophic warming, **we need to start getting off of *all* fossil fuels** ASAP.

I'll end with some more background detail on the study from *Nature*:

The first clues appeared in 2007, when NOAA researchers noticed occasional plumes of pollutants including methane, butane and propane in air samples taken from a 300-metre-high atmospheric

monitoring tower north of Denver. The NOAA researchers worked out the general direction that the pollution was coming from by monitoring winds, and in 2008, the team took advantage of new equipment and drove around the region, sampling the air in real time. Their readings led them to the Denver-Julesburg Basin, where more than 20,000 oil and gas wells have been drilled during the past four decades.

Most of the wells in the basin are drilled into 'tight sand' formations that require the same fracking technology being used in shale formations. This process involves injecting a slurry of water, chemicals and sand into wells at high pressure to fracture the rock and create veins that can carry trapped gas to the well. Afterwards, companies need to pump out the fracking fluids, releasing bubbles of dissolved gas as well as burps of early gas production. Companies typically vent these early gases into the atmosphere for up to a month or more until the well hits its full stride, at which point it is hooked up to a pipeline.

The team analysed the ratios of various pollutants in the air samples and then tied that chemical fingerprint back to emissions from gas-storage tanks built to hold liquid petroleum gases before shipment. In doing so, they were able to work out the local emissions that would be necessary to explain the concentrations that they were seeing in the atmosphere. Some of the emissions come from the storage tanks, says Pétron, **"but a big part of it is just raw gas that is leaking from the infrastructure". Their range of 2.3–7.7% loss, with a best guess of 4%, is slightly higher than Cornell's estimate of 2.2–3.8% for shale-gas drilling and production. It is also higher than calculations by the EPA, which revised its methodology last year and roughly doubled the official US inventory of emissions from the natural-gas industry over the past decade. Howarth says the EPA methodology translates to a 2.8% loss.**

The Cornell group had estimated that 1.9% of the gas produced over the lifetime of a typical shale-gas well escapes through fracking and well completion alone. NOAA's study doesn't differentiate between gas from fracking and leaks from any other point in the production process, but Pétron says that fracking clearly contributes to some of the gas her team measured.

Capturing and storing gases that are being vented during the fracking process is feasible, but industry says that these measures are too costly to adopt. An EPA rule that is due out as early as April would promote such changes by regulating emissions from the gas fields.

Officials with America's Natural Gas Alliance, based in Washington DC, say that the study is difficult to evaluate based on a preliminary review, but in a statement to *Nature* they add that "the findings raise questions and warrant a closer examination by the scientific community".

I think a NAS study is warranted, but these actual measurements, coupled with the myriad other analyses raising questions about the “dash to gas,” are more than reason enough to slow down any major investment in natural gas infrastructure that we will be stuck with for decades.

Filling up existing underutilized natural gas power plants to generate electricity that displaces coal remains a reasonable near-term idea. But building a significant number of new natural gas fired power plants — or building a major infrastructure for natural gas vehicles, which don’t even have the efficiency benefits of gas power plants — remains a counterproductive lock-in of scarce resources needed elsewhere to avert catastrophic global warming.