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FROM THE
DIRECTOR OF
THE JOY LUCK CLUB

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Studies Say Natural Gas Has Its Own Environmental Problems

By TOM ZELLER Jr.

Natural gas, with its reputation as a linchpin in the effort to wean the nation off dirtier fossil fuels and reduce [global warming](#), may not be as clean over all as its proponents say.

Even as [natural gas](#) production in the United States increases and Washington gives it a warm embrace as a crucial component of America's energy future, two coming studies try to poke holes in the clean-and-green reputation of natural gas. They suggest that the rush to develop the nation's vast, unconventional sources of natural gas is logistically impractical and likely to do more to heat up the planet than mining and burning [coal](#).

The problem, the studies suggest, is that planet-warming methane, the chief component of natural gas, is escaping into the atmosphere in far larger quantities than previously thought, with as much as 7.9 percent of it puffing out from shale gas wells, intentionally vented or flared, or seeping from loose pipe fittings along gas distribution lines. This offsets natural gas's most important advantage as an energy source: it burns cleaner than other fossil fuels and releases lower carbon dioxide emissions.

"The old dogma of natural gas being better than coal in terms of greenhouse gas emissions gets stated over and over without qualification," said Robert Howarth, a professor of ecology and environmental biology at [Cornell University](#) and the lead author of one of the studies. Mr. Howarth said [his analysis](#), which looked specifically at methane leakage rates in unconventional shale gas development, was among the first of its kind and that much more research was needed.

"I don't think this is the end of the story," said Mr. Howarth, who is an opponent of growing gas development in western New York. "I think this is just the beginning of the story, and before governments and the industry push ahead on gas development, at the very least we ought to do a better job of making measurements."

The findings are certain to stir debate. For much of the last decade, the natural gas industry has carefully cultivated a green reputation, often with the help of environmental groups that

embrace the resource as a clean-burning “bridge fuel” to a renewable energy future. The industry argues that it has vastly reduced the amount of fugitive methane with new technologies and upgraded pipe fittings and other equipment.

Mark D. Whitley, a senior vice president for engineering and technology with [Range Resources](#), a gas drilling company with operations in several regions of the country, said the losses suggested by Mr. Howarth’s study were simply too high.

“These are huge numbers,” he said. “That the industry would let what amounts to trillions of cubic feet of gas get away from us doesn’t make any sense. That’s not the business that we’re in.”

Natural gas is already the principal source of heat in half of American households. Advocates like the former [oil tycoon T. Boone Pickens](#) have also long sought to promote it as a substitute for coal in electricity generation or gasoline in a new generation of natural gas cars. And the development of new ways to tap reserves of natural gas means production is likely to increase sharply.

Two weeks ago, [President Obama](#) included natural gas in his vision for America. Clark Stevens, a White House spokesman, said that the administration’s energy priorities were not about picking one energy source over another, but about diversifying the nation’s energy mix. “This process will continue to be based on the best science available to ensure our energy sources, including our nation’s natural gas reserves, are developed safely and responsibly,” Mr. Stevens said on Friday.

The ability to pull natural gas economically from previously inaccessible formations deep underground has made huge quantities of the resource available in wide areas of the country, including Texas, Louisiana, Pennsylvania, New York, Wyoming and Colorado.

Such unconventional gas production accounts for nearly a quarter of total production in the United States, according to the latest figures from the Energy Information Administration. That is expected to reach 45 percent by 2035.

But the cleanliness of natural gas is largely based on its lower carbon dioxide emissions when burned. It emits roughly half the amount of carbon dioxide as coal and about 30 percent less than oil.

Less clear, largely because no one has bothered to look, are the emissions over its entire production life cycle — that is, from the moment a well is plumbed to the point at which the gas is used.

Methane leaks have long been a concern because while methane dissipates in the atmosphere more quickly than carbon dioxide, it is far more efficient at trapping heat. Recent evidence has suggested that the amount of leakage has been underestimated. A report in January by the nonprofit journalism organization ProPublica, for example, [noted that the Environmental Protection Agency](#) had recently doubled its estimates for the amount of methane that is vented or lost from natural gas distribution lines.

Chris Tucker, a spokesman for Energy in Depth, a coalition of independent oil and natural gas producers, dismissed Mr. Howarth as an advocate who is opposed to hydraulic-fracturing or “fracking,” a practice associated with unconventional gas development involving the high-pressure injection of water, sand and chemicals deep underground to break up shale formations and release gas deposits. Mr. Howarth said his credentials as a scientist spoke for themselves.

Mr. Howarth included methane losses associated with flow-back and drill-out processes in hydraulic fracturing and other unconventional gas drilling techniques.

The study combined these emissions with studies of other methane losses along the processing and distribution cycle to arrive at an estimated total methane loss range from 3.6 to 7.9 percent for the shale gas industry.

The researchers include a recent study from the Goddard Institute for Space Studies at [NASA](#) suggesting that an interaction of methane with certain aerosol particles significantly amplifies methane’s already potent greenhouse gas effects, particularly over a 20-year time horizon. When all is factored together, Mr. Howarth and his colleagues conclude that the greenhouse gas footprint of shale gas can be as much as 20 percent greater than, and perhaps twice as high as, coal per unit of energy.

David Hughes, a geoscientist and research fellow at the Post Carbon Institute, an energy and climate research organization in California, used Mr. Howarth’s research as part of a [broader look at natural gas](#) as a substitute for coal in electricity generation and oil in transportation.

Mr. Hughes’s full report is scheduled to be released in May, but in a draft version shared with The New York Times, Mr. Hughes suggested that while natural gas would play an important role in the nation’s energy mix, both cases were practical impossibilities.

“I think it’s going to be very challenging, to put it mildly, to ramp up shale gas production by fourfold, which is the federal government’s projection for 2035,” Mr. Hughes said. “I’m not saying it can’t be done, but if it was done, the amount of drilling you’re looking at to make that happen is staggering.”

Mr. Hughes, using Mr. Howarth's calculations, also concludes that replacing coal with natural gas for base load electricity production will most likely make greenhouse gas emissions worse. It would be better, he argues, to improve energy efficiency, rely on natural gas in niche vehicle markets and balance continued construction of wind and [solar power](#) to produce electricity.

David Hawkins, the director of climate programs with the [Natural Resources Defense Council](#), said that much could be done by regulators to nudge drillers to capture more of the fugitive methane, but that it is often more economical for industry to simply let it escape.

Mr. Hawkins also said that too little was known about just how much methane was being lost and vented, and that studies like Mr. Howarth's, while needed, relied on too slim a data set to be considered the final word.

"This is a huge and growing industry, and we just don't have the information we need to make sure that this resource is being developed as cleanly as it can be," Mr. Hawkins said.

"We view his shining a flashlight into this dark closet to be a service," Mr. Hawkins added, "but the flashlight is still a dim one, and we still can't see everything in the closet."

This article has been revised to reflect the following correction:

Correction: April 15, 2011

An earlier version of this article misstated the amount of carbon dioxide produced by burning natural gas, relative to oil. Gas emits about 30 percent less carbon dioxide than oil, not 30 percent as much as oil.