



Methane: A Uniquely Difficult Greenhouse Gas Mitigation Problem

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How much do methane emissions associated with natural gas production contribute to global warming?

Currently, we just don't know, Robert Kleinberg said in Monday's energy policy seminar at the Harvard Kennedy School.

Methane, Kleinberg explained, is a greenhouse gas that is a much more potent cause of warming, in the short term, than an equal quantity of carbon dioxide. Furthermore, the "short term," for methane, is measured in decades, not years. Methane disintegrates in the atmosphere relatively quickly (about 80% is gone within 20 years), but its warming effects linger—thus, even a century after it is emitted, the warming effect of methane is 25 times that of the same amount of carbon dioxide, Kleinberg reported, citing a 2012 analysis published in the *Proceedings of the National Academy of Sciences*.



As Kleinberg explained, natural gas has been displacing coal in electric power generation, resulting in reduced carbon dioxide emissions. In and of itself, this transition from coal to gas would be expected to lead to reduced greenhouse gas emissions when these fuels are burned. However, Kleinberg noted, the net impact on climate change of increased use of natural gas depends on the balance between the reduction in carbon emissions during combustion and the increase in methane emissions associated with leaks during the production and transportation of natural gas. Whether the net impact on the environment of a transition from coal to natural gas is a reduction or an increase in global warming depends on how much methane is released related to natural gas production. Current estimates, Kleinberg said, put the break-even leakage level at about 2.5% of methane used—any leakage amounts above that point suggest that the world might be better off using coal to generate electricity, rather than natural gas, at least from a global warming perspective (setting aside consideration of other pollutants).

So how much methane is leaking? Kleinberg emphasized how imprecise our knowledge of methane emissions is. Methane emissions are primarily the result of leaks from natural gas production, processing, transportation, and distribution systems. Equipment exists, regulated by government standards, to find and measure leaks, and if you know where a leak is, you can repair it. However, Kleinberg, who tested this equipment, reported that it is very difficult to get accurate readings in real-world conditions, where even a light breeze can blow methane leaks away from the sensors meant to detect them.

Recognizing that existing sensors miss or mis-measure many leaks, what is the way forward? Kleinberg reported that the Environmental Defense Fund and its academic and industrial partners are currently engaged in a project that focuses on identifying the biggest leaks—the "super-emitters." Calculations suggest that 88% of methane emissions may result from the worst 10% of leaks—so if a way could be found to identify such leaks reliably, this could result in significant progress. EDF is leading a program that has the potential to identify such leaks by means of airborne surveys; however, it is too soon to know whether this methodology will be successful, Kleinberg said.

Overall, Kleinberg concluded, methane leakage is not a problem that lends itself to obvious policy answers. In the best cases, companies that sell natural gas may be motivated to address this problem aggressively, since methane that leaks is a product they can't sell. However, Kleinberg noted, many leaks occur in facilities not connected to natural gas pipelines,

so companies may not have an opportunity to sell recaptured gas. The economists' ideal solution, of putting a price on externalities, through a tax or through cap and trade, is also problematic in this case. "You can't tax what you can't measure," Kleinberg observed, concluding that getting control over methane emissions remains "a challenging problem in energy technology innovation policy."

Kleinberg spoke as part of the Kennedy School's Energy Policy Seminar Series, which is sponsored by the Consortium for Energy Policy Research of the Mossavar-Rahmani Center on Business and Government and by the Belfer Center for Science and International Affairs. ([Link to presentation](#)).