

How Green is Natural Gas?

Natural gas is widely touted as a “green” source of energy because it releases fewer greenhouse gases (GHG) than does coal *when it is burned*. Obtaining natural gas, however, causes the emission of significant amounts of heat-trapping GHG during exploration, extraction, processing, and transmission.

Drilling the Marcellus Shale would actually **increase** New York's carbon footprint, not reduce it.

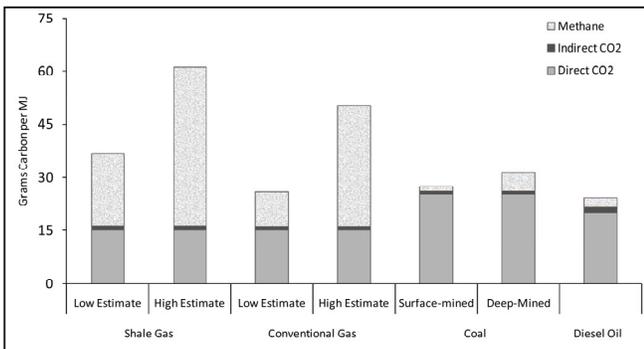
Prof. Robert Howarth of Cornell University has done a preliminary assessment of the total greenhouse gas emissions associated with natural gas extraction through high-volume

hydraulic fracturing (HVHF). He estimates that HVHF-extracted natural gas contributes **1.2 to 2.1 times more to global warming** over a 20-year period than does coal, per unit energy gained; over a 100-year period they are comparable. The time frame is important because methane, a large component of HVHF’s impact on global warming, is a far more potent greenhouse gas than carbon dioxide, but has a shorter lifespan in the atmosphere before breaking down.¹

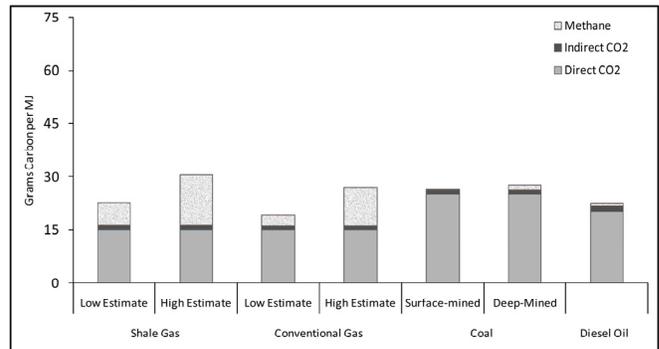
Howarth, et al.’s estimate that **3.6% to 7.9%** of methane produced by HVHF is leaked to the atmosphere is comparable to the rate in a recent EPA publication² and other peer-reviewed studies.^{3,4}

Howarth’s work is the most complete life cycle analysis of the GHG emissions from gas extraction using HVHF. No one has done a full accounting of the other external costs of drilling in the Marcellus Shale.

A. 20-year time frame



B. 100-year time frame



These figures from Howarth’s work show the relative global warming impact (converted to the equivalent of grams of carbon emitted per unit energy produced) of natural gas (both HVHF-extracted shale gas and conventional gas) compared to coal and diesel oil. In all cases, HVHF-extracted gas is at least as bad as coal.

Sources of Greenhouse Gases from Unconventional Drilling:^{5,6}

1) Combustion of Fossil Fuels to Extract Natural Gas (emits various GHGs, including CO₂, SO_x and NO_x):

- **Transportation** to move equipment, to bring workers to the area and to work sites, and especially to transport millions of gallons of water to and from each well every time the well is fracked uses large amounts of fuel.
- **Operation of diesel and other engines** for drilling, processing and transmission of gas uses lots of fuel.
- **Flaring** (intentional burning of gas at the well site until the well is capped or connected to a pipeline).
- **Storage and/or treatment of produced water** can only be done at specialized (and thus usually distant) locations. Removing the toxic chemicals from the water uses additional energy.

The Tompkins County Planning Department estimates that, over 30 years, the number of wells likely to be drilled in Tompkins County would generate GHG emissions equivalent to the amount that would be produced in 516 years from *all* other local sources.⁷

2) Releases of Unburned Methane (which traps 72 times as much heat as does CO₂)⁸

- **Leaks** begin during exploration as methane is released from overlying formations; leaks also result from improper casings, or from migration of gas released during fracking.
- **Fugitive emissions** from storage tanks, valves, compressors, and pipelines.

3) Destruction of Plants that take CO₂ out of the Atmosphere⁹

- **Trees and fields are cleared** from thousands of acres for well pads, holding ponds, gathering lines, compressor stations, and transmission lines, plus access roads to all of the above. In PA, researchers have measured the average cleared area per Marcellus shale well pad at 8.8 acres.¹⁰
- **Air pollution, especially ozone**, from compressors and truck traffic slows growth of plants,¹¹ including grapes and other crops.
- **Soil compacted** by heavy equipment damages plant roots and microorganisms in the soil.

Ozone levels have gotten so high in rural Pinedale, Wyoming (home of the Pinedale Anticline gas field), that in recent winters they have rivaled the worst bad-ozone days in major cities such as Los Angeles.¹¹

References

- ¹ Howarth, R. W., R. Santoro, and A. Ingraffea. 2011. "Methane and the Greenhouse-Gas Footprint of Natural Gas From Shale Formations." *Climatic Change Letters*, DOI: 10.1007/s10584-011-0061-5. <http://www.eeb.cornell.edu/howarth/Howarth et al 2011.pdf>
- ² EPA. November 2010. "Greenhouse Gas Emissions Reporting from the Petroleum and Natural Gas Industry: Background Technical Support Document." http://www.epa.gov/climatechange/emissions/downloads10/Subpart-W_TSD.pdf
- ³ Hayhoe, K., Kheshgi, H.S., Jain, A.K., Wuebbles D.J. 2002. "Substitution of Natural Gas for Coal: Climatic Effects of Utility Sector Emissions." *Climatic Change*, **54**: 107-109.
- ⁴ Lelieveld, J., et al. 2005. "Low Methane Leakage from Gas Pipelines." *Nature*. **434**: 841-842.
- ⁵ See reference in Footnote 2, especially Table 1 on p. 9 and Table 2 on p. 10.
- ⁶ Earthworks. *Sources of Oil and Gas Air Pollution*. <http://www.earthworksaction.org/airpollutionsources.cfm>
- ⁷ Tompkins County Planning Department comments to NYSDEC, Dec. 2009 accessed on 1/20/2010 at http://www.tompkins-co.org/planning/energyclimate/documents/PlanningDeptcommentsfinal12_30.pdf
- ⁸ According to the latest report from the Intergovernmental Panel on Climate Change (IPCC 2007), methane's effect on global warming is 72 times greater than that of CO₂ when measured over a 20-year period and 24 times greater when measured over a 100-year period.
- ⁹ See, for example "Land Use and Habitat Fragmentation of Oil Sands Production: A Life cycle Perspective," Jordaan, S., et al. University of Calgary/Institute for Sustainable Energy Environment and Economy, September 2009.
"Methods for the inclusion of landscape fragmentation in life cycle assessment are not well established....The results suggest that land disturbance due to natural gas production can be relatively large per unit energy." (from the abstract)
- ¹⁰ Johnson, Nels. November 15, 2010. "Pennsylvania Energy Impacts Assessment, Report 1: Marcellus Shale Natural Gas and Wind." The Nature Conservancy.
- ¹¹ United States Department of Agriculture Agriculture Research Service. Accessed 4/28/10. *Effects of Ozone Air Pollution on Plants*. <http://www.ars.usda.gov/Main/docs.htm?docid=12462>.
- ¹² Hargreaves, Steve, Small Town, Big Changes, CNNMoney.com, October 20, 2008.