

Maryann Sargent

Research Scientist
Harvard University
20 Oxford St.
Cambridge, MA 02138
(617) 495-4566

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Today I'd like to tell you about results from my research which used atmospheric measurements of methane to calculate emissions from natural gas infrastructure in the Boston urban area. We used what is called a top-down method for calculating emissions, which means we measured the methane concentration in the atmosphere and used wind data and meteorological models to calculate emissions. We assessed emissions from 2012-2020 and found that the total emissions were 6 times higher than the estimate from the MassDEP. We also saw no change in emissions between 2012 and 2020, and no impact from the 2018 regulation of pipeline leaks with Significant Environmental Impact.

So why should you believe my study rather than the MassDEP estimate? The DEP uses a method called a bottom-up inventory. They calculate emissions by measuring the leaks for a sample of pipeline types, meters, compressor stations, etc., and multiplying that by the total miles of pipeline, number of meters to determine total emissions. This method is very effective for gases like carbon dioxide because CO₂ is only emitted where it is burned, and we know how much CO₂ is released for every gallon of gasoline, etc that is burned. On the other hand, methane emissions are very different because they can escape at any point along the supply chain from the well pad up to the consumer. It's very easy for bottom-up methods to miss sources or sectors that leak along the long supply chain because it can happen in so many different places. Bottom-up inventories also struggle to account for "superemitters", where a large portion of the methane emitted is from a small number of pipes/meters/appliances that have much larger emissions than the average. If the sample tested for leaks does not contain a representative number of strong emitters, the total emissions can be biased low. On the other hand, our top-down method looks at the atmosphere, which accumulates emissions from all sources, so won't miss any sectors or sources the way the bottom-up inventory can. Another reason to trust top-down studies is that we compared top-down emissions from 12 studies in 6 US cities, and all calculated emissions that were at least double bottom-up estimates, and they ranged from 2-10x higher than the bottom-up studies. These studies were carried out by different research groups using different methodologies, but consistently showed that bottom-up studies are missing a big chunk of methane emissions.

Natural gas is sold to us as having lower greenhouse emissions than other fuels – however, at the loss rates we calculate for Boston, those greenhouse benefits are significantly undercut. So I urge you when accounting for the greenhouse impact of natural gas to note that its methane emissions are likely ~6-fold higher than what is currently used in state estimates. I also want you to take away from my study that the state's significant efforts to reduce pipeline leaks haven't produced any measurable change in the emissions we calculate based on the atmosphere. New leaks spring up from our aging infrastructure as fast as we're able to repair them - we're playing whack-a-mole here. So both the high emissions from our infrastructure and the lack of progress in reducing leaks point to the best solution being to move away from

reliance on natural gas and towards green energy as quickly as possible if we are to meet our climate goals.