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PAYNE COMMENTARY SERIES: **VIEWPOINT**

Integrating Technology and Incentives to Reduce Methane Emissions

By Mark Agerton and Ben Gilbert
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Abstract:
Payne Institute Faculty Fellow Ben Gilbert and UC Davis economist Mark Agerton discuss economic considerations with using remote sensing in methane emissions policy. A two-tiered monitoring system like the recently proposed Methane Emissions Reduction Act is a powerful tool to achieve emissions reductions. However, there are important considerations in how to design such a system. A two-tiered system could facilitate emissions pricing and responsible gas markets, reward innovative producers, and fund programs for further climate change mitigation while easing the impact of the energy transition on oil and gas communities.

Integrating Technology and Incentives to Reduce Methane Emissions

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Reducing methane emissions would go a long way to helping us meet ambitious climate targets because methane is a powerful greenhouse gas: the global warming potential of methane is 84—87 times that of CO_2 over 20 years and 28—36 times over 100 years.[1] The oil and gas industry is the second-largest domestic source of anthropogenic methane emissions (28%) after agriculture.[2] Fortunately, a number of studies have found that the industry should be able to achieve significant methane reductions at modest costs.[3][4][5] In this Comment, we describe how technological advances in remote sensing can be integrated with economic policy to efficiently reduce emissions.

The importance of methane emission reductions is underscored by the U.S. government's social cost of methane estimate of $31/mcf, about 10 times the market price of natural gas.[6] Because the price of natural gas is relatively low, producers have little financial incentive to reduce emissions by capturing and selling the methane they release. Pricing methane emissions is a straightforward way to help oil and gas producers prioritize methane emission reductions. Pricing could occur through state or federal emissions fees, or "responsible gas markets" in which certified low-methane producers receive a market premium.

For pricing to work, we have to be able to measure firms' emissions. Fortunately, technologies for remote sensing and quantification are rapidly advancing. No single technology can give a complete picture of a producer's methane emissions, but a technology portfolio can. Satellite instruments like TROPOMI can measure regional methane concentrations. Airplanes, drones, and vehicles with specialized instruments can take site-specific methane readings at a point in time. Tall towers spaced throughout a producing field can continuously sample atmospheric methane concentrations, and pairing these samples with wind velocities can tell us where emissions come from. Handheld infrared cameras detect methane emissions from smaller pieces of equipment like pressurized valves. Working with Project Canary, Payne Institute Fellows are evaluating methane detection technologies in the wild[7] in order to build a "digital canopy" – a remote sensing technology portfolio to quantify emissions.[8]

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[1] https://www.epa.gov/ghgemissions/understanding-global-warming-potentials
[2] U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018. https://www.epa.gov/ghgemissions/overview-greenhouse-gases
[3] https://www.iea.org/data-and-statistics/charts/marginal-abatement-cost-curve-for-oil-and-gas-related-methane-emissions-globally
[4] Marks, Levi. "The Abatement Cost of Methane Emissions from Natural Gas Production." http://www.levimarks.com/research
[5] Werner, Karl Dunkle and Wenfeng Qiu. "Hard to Measure Well: Can Feasible Policies Reduce Methane Emissions?" https://karldw.org/papers/Karl_Dunkle_Werner_JMP.pdf
[6] Interagency Working Group on Social Cost of Greenhouse Gases, "Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990. https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf. Table ES-2 year 2020 cost of $1,500 per ton with a conversion of 48.7 mcf/ton implies a SCM of $30.80/mcf.
[7] "INITIAL FINDINGS FROM CONTINUOUS MONITORING OF OIL AND GAS OPERATIONS", 1/13/2021
[8] "A DIGITAL CANOPY: GETTING TO TRANSPARENCY", 4/30/2020

Two-tiered monitoring and incentives

A two-tiered monitoring and incentive system like the Methane Emissions Reduction Act just proposed by Sens. Whitehouse, Booker, and Schatz[9] moves towards a methane policy that integrates technology and incentives. Under a two-tiered system, all producers pay the same emissions fee per unit of methane attributed to their facilities. The two tiers come in how emissions get attributed. Producers in the default Tier 2 accept a coarse estimate of their emissions based on public data. Firms that want more accurate attribution can join Tier 1 and pay for more precise monitoring. A two-tiered system provides firms direct incentive to reduce emissions, but gives them maximum flexibility. It also facilitates the development of new low-methane markets for natural gas, similar to markets for green energy.

In Tier 2, regulators use publicly available satellite data to quantify total emissions in a producing region over a given period. Regulators attribute shares of this regional total to each producer based on something easily measurable, like their production or number of wells. Producers pay an emissions fee on their attributed share of regional emissions. All producers default into this coarser Tier 2 monitoring.

Producers that employ best practices to reduce emissions don't have to settle for Tier 2 monitoring. They can pay for more costly, Tier 1-level monitoring with a portfolio of technologies. A portfolio is costly, especially for small producers, but exhibits economies of scale. A regional consortium of companies could jointly fund a monitoring portfolio and lower the cost of Tier 1 monitoring to its members. For example, a single airplane can monitor many producers' facilities. The regulator or a credible third party would use Tier 1 data to assess each producer's emissions.

The regulator subtracts the (now) known emissions of Tier 1 producers from the total regional estimate, attributing the remainder to Tier 2 producers. Because Tier 1 producers will tend to be low-emitters, the average emissions attributed to each producer in Tier 2 increases. Although all firms pay the same emissions fee per unit of methane, total emissions fees for Tier 2 producers increase as more firms join Tier 1. Tier 2 attributions also become more accurate as the number of firms in Tier 2 shrinks. Tier 1 monitoring costs per firm could decline if Tier 1 producers join monitoring consortia.

Additional consideration for a two-tiered system

There are some important considerations for any two-tiered system. These will influence the effectiveness of the policy, as well as the winners and losers.

- *Allocating shares of Tier 2 regional methane emissions.* The regulator uses producers' observable activities to allocate total regional methane emissions. The corresponding methane fees will act as an implicit tax on those activities. For example, if emissions shares are based on gas production, firms will pay more in fees if they produce more gas. This creates incentives to reduce gas production, not necessarily emissions per unit of production.
- *How to define the region boundaries for Tier 2.* Satellite measurements are less precise at narrow geographic scales, but measurement errors cancel out at wider levels of aggregation. This presents an important

[9] Methane Emissions Reduction Act. https://www.whitehouse.senate.gov/news/release/whitehouse-booker-schatz-unveil-methane-fee-to-clamp-down-on-potent-driver-of-climate-change

tradeoff. If the Tier 2 region is smaller, then regional estimates will be noisier, but more closely tied to individual firms. These firms will get more credit for any emissions reductions they make. The recently introduced Methane Emissions Reduction Act uses large Tier 2 regions. If these could be narrowed, it might provide Tier 2 firms stronger incentives to reduce methane emissions.

- *Standards development for global low methane certification.* We need transparent standards for low methane emissions gas to support a global market for responsible gas. By establishing sound Tier 1 protocols, the U.S. can provide leadership and a template for international standards.
- *Use of the emissions fee revenue.* There are several sensible options for using the revenue raised from methane emission fees. The recently introduced Methane Emissions Reduction Act suggests that funds be spent on developing resilience in coastal communities likely to be affected by climate change. An alternative approach would be to use some of the fee revenue to fund a federal program to clean up orphaned wells. Orphaned wells are ones without owners, either because the owners have gone out of business or are now insolvent. Cleaning up orphaned wells will directly reduce methane emissions, create green jobs, and potentially employ displaced oilfield workers.[10] This would help ease the energy transition for oil and gas dependent communities. A related approach would be to use the fee revenue to assist workers from firms that go out of business as a result of introducing the methane fee.
- *Comparison to traditional policies.* This two-tiered monitoring and incentive system is a departure from more traditional, prescriptive policies that mandate specific emissions control technologies such as low-bleed or no-bleed pneumatic controllers at production sites. These policies may still have a role in preventing emissions from sources that are hard to detect using remote sensing. However, emissions control technology standards that are too specific may reduce incentives for innovation in emissions reduction methods.
- *Supply chain considerations.* Supply chain constraints may be an important factor in methane emissions.[11][12] Even if upstream producers can detect and reduce emissions, limitations in pipeline and processing capacity may reduce the effectiveness of upstream efforts. A comprehensive emissions reduction policy needs to consider both emissions rates and capacity limitations throughout the entire natural gas supply chain.

[10] Bordoff, Jason, Daniel Raimi and Neelesh Nerurkar. "Green Stimulus for Oil and Gas Workers: Considering a Major Federal Effort to Plug Orphaned and Abandoned Wells." https://www.energypolicy.columbia.edu/research/report/green-stimulus-oil-and-gas-workers-considering-major-federal-effort-plug-orphaned-and-abandoned

[11] https://www.bakerinstitute.org/research/economics-natural-gas-flaring-us-shale-agenda-research-and-policy/,

[12] https://acp.copernicus.org/preprints/acp-2020-1175/

Conclusion

A two-tiered methane emissions monitoring and fee system like the Methane Emissions Reductions Act is a powerful tool to help us reduce our greenhouse gas emissions. This new kind of policy gives producers maximal flexibility in how they reduce emissions. In doing so, it helps keep the cost of reducing emissions down, allowing us to shoot for more ambitious greenhouse gas reductions. It's also a way for the U.S. to lead the development of global responsible gas markets that reward responsible producers, and to encourage the development of new emissions monitoring technologies. We encourage policy-makers to be thoughtful about how they design two-tiered monitoring policies in order to make them effective.

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