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VIA Electronic Filing

California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Public Workshop to Discuss Potential Changes to the Low Carbon Fuel Standard

Dear Chair Randolph,

Project Canary appreciates the opportunity to provide public comments on the August 18, 2022 California Air Resources Board (CARB) Public Workshop to Discuss Potential Changes to the Low Carbon Fuel Standard (LCFS). The Low Carbon Fuel Standard has set the bar as a key piece of regulation and a major driver of reduction in carbon intensity in the California transportation market. Project Canary supports California's continued efforts to decarbonize its transportation system and the evaluation of technology, trends, and additional considerations before moving into a formal rulemaking. Project Canary provides these comments in support of the state's ongoing review of the LCFS and offers additional information regarding the use of rapidly developing technology to measure and remediate methane, a short-lived pollutant, as well the opportunity to use certified low emission gas, or certified gas, as tools that support the 2022 Scoping Plan Update and its alignment with the LCFS. The ability to mitigate methane will make an immediate impact on climate change today through increased measurement, monitoring, quantification, and remediation of fugitive methane emissions from the entire energy supply chain.

The Project Canary comments focus on two primary areas.

1. Project Canary supports the potential Emission Factor updates, specifically for fugitive emissions from fossil natural gas production and pipelines. The emissions measurement and monitoring market has changed rapidly in the last two years, and continuous, real-time emissions measurement and quantification is readily available and affordable.
2. The use of direct measurement supports the alignment of the LCFS and the 2022 Scoping Plan Update through the shared goal quantifying and mitigating greenhouse gases to decarbonize the energy supply chain.

About Project Canary

Project Canary (or the "Company") is a technology and data company that offers a suite of services designed to help lower the environmental impact of natural gas production, transportation, and distribution, including the rigorous, independent emissions monitoring and operational certification of fossil natural gas throughout the energy value chain. Our thesis is that methane leaks in upstream oil and gas facilities are preventable, and we can stop the leaks. Project Canary also offers a robust, independent certification regime for operations that can identify and track certified gas from wellhead to burner tip using both quantitative and qualitative metrics to measure impacts on air, water, land, and communities. By significantly reducing the fugitive methane associated with natural gas,[1] certified gas offers a valuable opportunity to fully realize the promise of natural gas as a reliable, affordable, and environmentally friendly fuel source that supports reliability in heating and electric power generation. Certified Gas is natural gas is a low carbon fuel that an independent third party has verified using specific standards and practices in all phases of operations to minimize methane and other greenhouse gases and climate and other environmental effects.

CARB Should Consider Direct Measurement in Lieu of Emissions Factors for Fossil Natural Gas Production and Pipelines

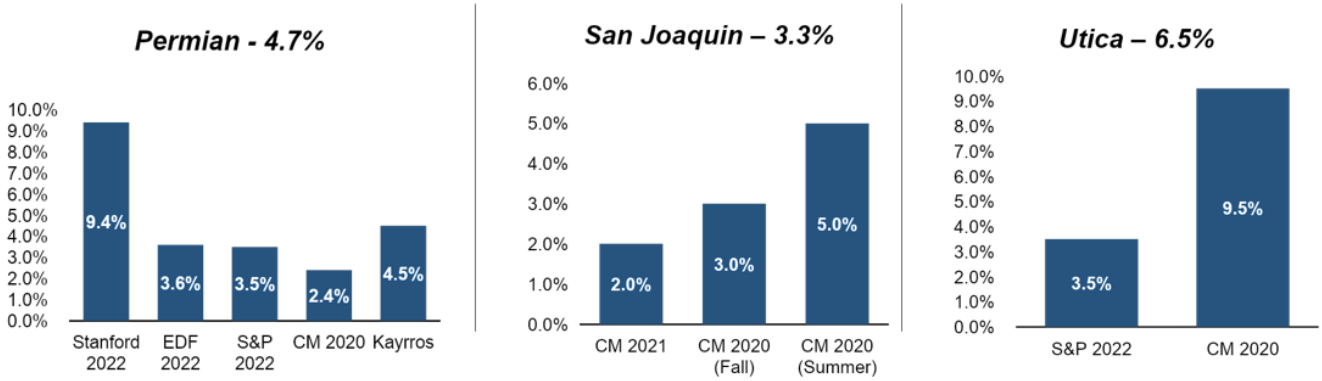
The technology is now available to provide at an affordable cost real-time, continuous monitoring services to measure, reduce, and even eliminate fugitive methane and other harmful emissions from the natural gas production and transportation process. Like renewable natural gas, certified gas is produced at lower methane intensity and the reduction in methane emissions can be monitored, quantified, and compared to the average of the basin the gas was produced in. Emission Factors (EF) have been established to support the calculation and determination of GHG emissions at both the state and federal level. However direct measurement possesses several advantages over emissions factors. Direct measurement can detect methane emissions faster both from the site and specific leak location, capture intermittent emissions that periodic surveys may not, provide rapid verification of repairs, and collect additional temporal information that can help operators achieve best practices. Numerous peer-reviewed studies have demonstrated that emissions from oil and natural gas operations are intermittent.[2]

[1] Methane has a relatively high Global Warming Potential ("GWP"). As a result, reduction of fugitive methane emissions is a powerful tool for reducing total equivalent greenhouse gas emissions.

[2] Allen, David T., Felipe J. Cardoso-Saldaña, and Yosuke Kimura, Variability in spatially and temporally resolved emissions and hydrocarbon source fingerprints for oil and gas sources in shale gas production regions, *Environmental science & technology* 51, no. 20 (2017): 12016-12026; Valeria Di Filippo, Ammar Abdilghanie Mohammed, Jianmin (Jimmy) Zhang, Ashraf El-Messidi, Pejman Kazempoor, Nasr Alkadi, Measurement-Based Emission Factors Using BHGE Advanced Methane Sensing Technologies and Analytics (Mar. 31, 2019), Environment and Climate Change Canada (ECCC) Project GCXE18S024. Technical Report; Cardoso-Saldaña, Felipe J. and David T. Allen, Projecting the Temporal Evolution of Methane Emissions from Oil and Gas Production Sites, *Environmental Science & Technology* 54, no. 22 (2020): 14172-14181; Variability observed over time in methane emissions from abandoned oil and gas wells, *International Journal of Greenhouse Gas Control* 100 (2020): 103116; Tullos, E. E., Stokes, S. N., Cardoso-Saldaña, F. J., Herndon, S. C., Smith, B. J., and Allen, D. T., Use of Short Duration

This variability may be more pronounced with respect to high emissions events; one study[3] found that high emission events are brief and concluded that "short-term sampling is likely to miss them." Additionally, the variability in emissions rate is largely not caused by changes in production rate. In fact, one study found that production variability only accounts for 10 percent of the observed variability in emissions rate.[4] All of these factors lead to the conclusion that emissions factors themselves are not accurate. The current EPA-reported average methane leak rate across the US of 0.454% is likely significantly underestimated based on studies from Stanford[5], EDF[6], S&P Global[7] and Carbon Mapper[8].

Table 1: Studies Showing Average Actual Emissions for Select Basins



Direct measurement of methane emissions is now readily available, and empirical data should be used when available. If needed, emissions factors should be updated to reflect the results of recent technological advances. In addition, operators that have already implemented direct monitoring should be allowed to provide data that supports their actual greenhouse gas emissions profiles instead of using emissions factors. The use of direct measurement to reduce methane in upstream production has a significant impact on the environment, as seen in Table 2. If operators can maintain a methane intensity of 0.2% instead of the currently reported 0.454%, that is the equivalent of 270,000 gasoline-powered cars off the road for one year.

[3] Riddick, Stuart N., Denise L. Mauzerall, Michael A. Celia, Mary Kang, and Karl Bandilla, Variability observed over time in methane emissions from abandoned oil and gas wells, *International Journal of Greenhouse Gas Control* 100 (2020): 103-116.

[4] Brantley, Halley L., Eben D. Thoma, William C. Squier, Birnur B. Guven, and David Lyon, Assessment of methane emissions from oil and gas production pads using mobile measurements, *Environmental Science & Technology* 48, no. 24 (2014): 14508-14515.

[5] Quantifying Regional Methane Emissions in the New Mexico Permian Basin with a Comprehensive Aerial Survey Yuanlei Chen, Evan D. Sherwin, Elena S.F. Berman, Brian B. Jones, Matthew P. Gordon, Erin B. Wetherley, Eric A. Kort, and Adam R. Brandt. *Environmental Science & Technology* 2022 56 (7), 4317-4323. DOI: 10.1021/acs.est.1c06458

[6] https://business.edf.org/files/ESG-by-EDF-EPA-Methane-Regulation-Proposal-Comments-Analysis.pdf

[7] https://www.spglobal.com/commodityinsights/en/products-services/natural-gas/methane-intensity-premiums#:~:text=Overview%20%2D%20Methane%20Intensity%20Premiums&text=MPCs%20are%20traded%20separately%20from,natural%20gas%20production%20is%200.437%25.

[8] Carbon Mapper 2020, CarbonMapper.org

Other LCFS technologies such as renewable natural gas can also benefit from direct measurement by proving the actual greenhouse gas emissions during production. A value to both the producer, the consumer, and the environment.

Table 2: Carbon Abatement is Significant When Procuring Certified Gas

Realistic U.S National Average	
MMBtu procured methane	268,000,000
MMBtu per mcf	1.04
mcf procured	258,437,801
kg per mcf of methane	18.86
kg of methane	4,873,878,496
Methane Intensity[1]	4.68%
kg methane emitted	228,097,514
MT methane emitted	228,098
Methane GWP (20 year)[3]	82.5
MT of CO2e emitted	***18,818,045***
EU ETS Price	79.56
Buyer Benefit of RSG	***$1,497,163,650***

Typical Upstream Producer	
MMBtu procured methane	268,000,000
MMBtu per mcf	1.04
mcf procured	258,437,801
kg per mcf of methane	18.86
kg of methane	4,873,878,496
Methane Intensity[1]	0.45%
kg methane emitted	22,127,408
MT methane emitted	22,127
Methane GWP (20 year)[3]	82.5
MT of CO2e emitted	***1,825,511***
EU ETS Price	79.56
Buyer Benefit of RSG	***$145,237,670***

PROJECT CANARY	
MMBtu procured methane	268,000,000
MMBtu per mcf	1.04
mcf procured	258,437,801
kg per mcf of methane	18.86
kg of methane	4,873,878,496
Methane Intensity[2]	0.20%
kg methane emitted	9,747,757
MT methane emitted	9,748
Methane GWP (20 year)[3]	82.5
MT of CO2e emitted	***804,190***
EU ETS Price	79.56
Buyer Benefit of RSG	***$63,981,352***

[9]

The passage of the recent Inflation Reduction Act (IRA) was a significant step towards the decarbonization of our energy infrastructure. The language suggests that the federal government and the EPA will be seeking emissions reporting based on actual data not versus estimates through upcoming rulemakings. The IRA directs the EPA to revise Subpart W to ensure emissions reporting and associated charges are based on empirical data that accurately reflect emissions. The EPA is also currently taking comments on federal emissions factors withing Subpart W. Project Canary believes this is a direct attempt to minimize the use of emissions factors. California and CARB have the opportunity to make advances in this same space.

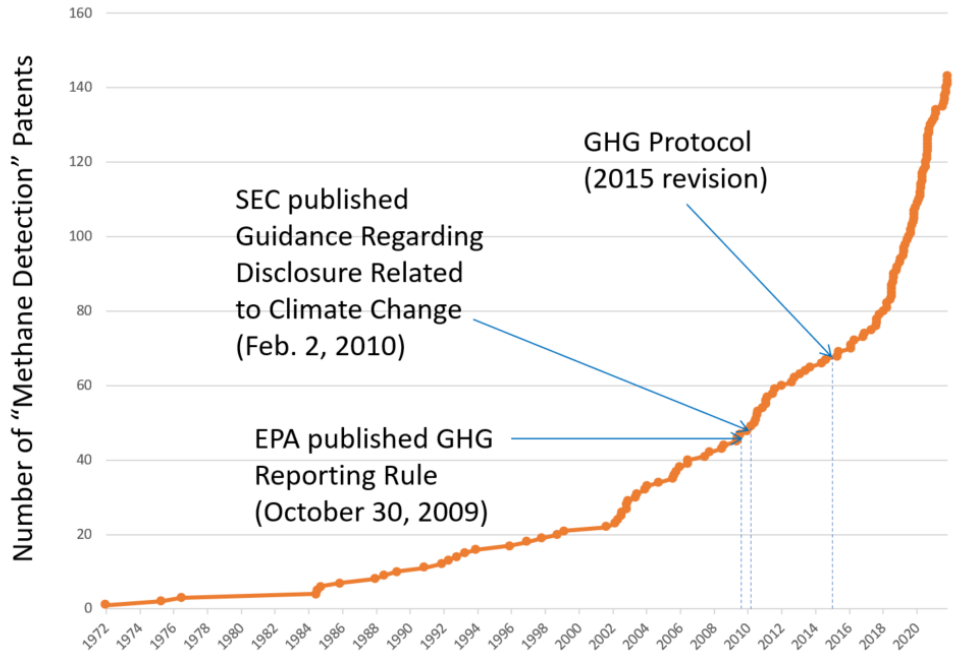
The proliferation of continuous monitoring technology is particularly notable in the energy sector, where there has been a pronounced convergence of regulatory and market pressures focused on GHG emissions reductions. A recent U.S. Government Accountability Office investigation found that entities in the oil and gas industry are voluntarily taking actions to reduce methane emissions from oil and gas development, including by using continuous monitoring technologies to detect methane emissions.[10]

[9] Sources: EPA, Wood and Mackenzie. (1) Stated EPA methane intensity of natural gas. Expresses methane emission per unit of gross gas production; the 0.454% figure includes only production operations and implicitly attributes all methane emissions from natural gas wells to natural gas production. (2) TrustWell® cutoff for certified gas methane intensity that a best-in-class operator can achieve. (3) The Intergovernmental Panel on Climate Change (IPCC) has indicated a GWP for methane of 82.5 when considering impact over a 20-year timeframe

[10] U.S. Government Accountability Office, *Oil and Gas: Federal Actions Needed to Address Methane Emissions from Oil and Gas Development*, at 15–16 (Apr. 2022), https://www.gao.gov/assets/gao-22-104759.pdf.

Project Canary alone has installed over one thousand five hundred continuous monitoring units (with hundreds more under contract) across the United States, Canada, and the United Kingdom at over five dozen major oil and gas and midstream companies.

Technological advancements have drastically expanded the availability and cost-effectiveness of direct, continuous monitoring of GHG emissions. In 2014, the U.S. Department of Energy's Advanced Research Projects Agency–Energy (ARPA-E) launched a $30 million R&D program called Methane Observation Networks with Innovative Technology to Obtain Reductions (MONITOR), to address the shortcomings of then-existing emission detection technologies that were labor-intensive, insufficiently precise, episodic, and costly. The MONITOR program facilitated transformational improvements resulting in low-cost, highly sensitive, automated technologies that can provide continuous and remote monitoring of emissions. Further evidence of this rapid technological progress can be found in the number of "methane detection" patents filed, a number which has doubled since the GHG Protocol was last revised in 2015 and tripled since the SEC published guidance regarding climate change disclosures and the U.S. Environmental Protection Agency published its GHG Reporting Rule.



Source: U.S. Patent and Trademark Office, Patent Public Search Version 1.0.4 (2022).

The industry is no longer constrained by technological limitations that drove regulators to call for indirect calculation rather direct measurement of GHG emissions.

Alignment with the CARB Scoping Plan

The CARB 2022 Scoping Plan Update is focusing on how California can achieve carbon neutrality through many paths for clean technology including energy deployment. To meet the state's long-term climate

objectives, we believe consideration of direct measurement, and ultimately the production and procurement of certified gas can play a significant role in assuring cumulative emissions reduction across the energy supply chain and a more balanced overall energy portfolio. A digital canopy with ground-based continuous emissions monitoring of high-volume facilities combined with satellite assessments, or flyovers of low-volume assets, would enable accurate measurement of methane emissions. Estimates, self-attestations, and extrapolations are no longer sufficient, as it is virtually impossible to achieve net-zero emissions using estimates.

The alignment between LCFS and the Scoping Plan Update is clear when one considers that California consumes 2.07 trillion cubic feet of gas annually (2020 Energy Information Administration data) and such gas is currently produced with an industry average methane intensity at the well pad level of 1.38% as estimated by EDF (a conservative estimate).[11] The reduction in carbon dioxide equivalent (CO2e) emissions that would result if all gas purchased in California had methane intensity of 0.20% equates to a reduction of 36,730,476 metric tons of CO2e[12].[13] This CO2e reduction is equivalent to taking 7,914,287 typical passenger vehicles off the road, or more than half of the roughly 14.2 million registered vehicles in California.[14]

The ability for CARB to move towards direct measurement for this sector supports the alignment between the LCFS and the 2022 Scoping Plan Update, through the overall goal of decarbonization.

Conclusion

As the staff at CARB considers the utilization of new technology and associated data critical to the success of the LCFS, Project Canary encourages the agency to explore the role of direct measurement technology and its uses in the upstream oil and gas production market as a means to measure and reduce associated emissions. While this has not historically been the role of the LCFS, the quickly developing technology is now available and affordable to drastically improve the emissions factors for the Fossil Natural Gas Production and Pipelines sector if not eliminate the need for them in their entirety. Project Canary recognizes and appreciates the efforts being undertaken by CARB to gather and analyze critical data that impacts the future of the LCFS. Direct measurement and ultimately the production and procurement of certified gas can play a role in the alignment between the LCFS and the overall Scoping Plan Update as well as help California meeting its long-term decarbonization goals. Direct measurement of greenhouse gas emissions at upstream and midstream oil and gas facilities is an affordable and available solution to directly impact the climate today.

[11] Alvarez, Ramón A., Daniel Zavala-Araiza, David R. Lyon, David T. Allen, Zachary R. Barkley, Adam R. Brandt, et al., "Assessment of methane emissions from the US oil and gas supply chain," Science 361, no. 6398 (2018): 186-188.
[12] assuming an 82.5 GWP x CO2e conversion factor
[13] EIA, https://www.eia.gov/tools/faqs/faq.php?id=46&t=8.
[14] EPA, Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

The Company appreciates the opportunity to provide these comments in this process and looks forward to further participation.

Sincerely,

Michelle Moorman Applegate
Project Canary
Sr. Director of Public Policy