Carbon Cycle Institute

DATE: 7/6/21
TO: CARB
RE: Comment on CARB DRAFT Analysis of Progress toward Achieving the 2030 Dairy and Livestock Sector Methane Emissions Target**,** June 2021
FROM: Carbon Cycle Institute

The Carbon Cycle Institute appreciates the opportunity to comment on the June 2021 Draft CARB Analysis of Progress toward Achieving the 2030 Dairy and Livestock Sector Methane Emissions Target (Draft)**.**

Global Warming Potential (GWP) of Biogenic Methane

As explained below, CA has ***already met*** its 2030 dairy methane reduction target with respect to actual GWP, while failing to meet its overall 2020 GHG reduction goals due to catastrophic wildfire emissions in that year. The opportunity remaining for the state, and the CA dairy industry, is to engage dairy farming as a *net carbon-negative* activity through continued deployment of the CDFA Dairy Digester and AMMP programs for further methane reductions, displacement of fossil fuel use for energy and fertilizer production, avoidance of methane from landfills and nitrous oxide emissions from agricultural soils via organics diversion to compost production and utilization to displace synthetic fertilizers.

The Draft states the 2030 emissions reductions target for the dairy and livestock sector is 40 percent below 2013 levels, a reduction of 9 MMTCO2e by 2030. This emissions reduction estimate is calculated using the 100-year GWP for methane (25 x CO2e); we note the 2017 Short-Lived Climate Pollutant Reduction Strategy estimated emissions using the 20-year GWP (75 x CO2e)[1]. While these are widely accepted GWP values for methane generally, they do not reflect recent advances in evaluating the climate impacts of biogenic methane (Allen et al 2018; Lynch et al 2020; Smith et al 2021).

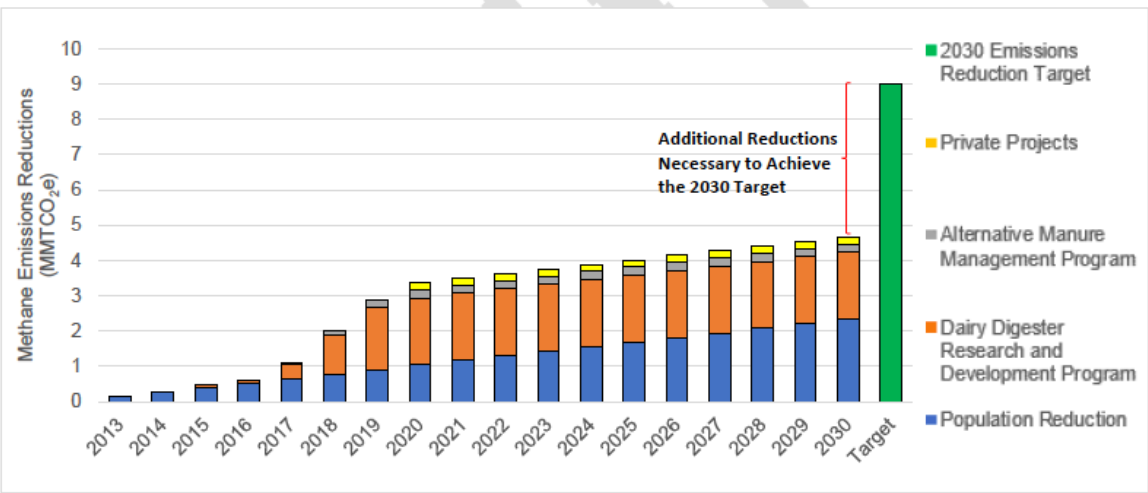
The emerging alternative to using 20-year or 100-year GWPs for biogenic methane - termed GWP*- more accurately reflects the impact of ruminant livestock methane emissions on global temperatures than conventional methods by representing methane's actual global warming effect over time (Allen et al 2018b). Allen et al (2018b) emphasize that, because of the short atmospheric life of biogenic methane, it is *changes in the rate* of methane emissions, rather than the annual emission rates themselves, that need to be considered in determining warming potentials. They note the following, of particular importance for ruminant livestock agriculture:

> • Past increases in methane emissions caused warming when they occurred, but constant methane emissions cause little additional warming because methane from that constant source is being lost from the atmosphere at the same rate that it is being added.
> • Gradually declining methane emissions (10% over 30 years, equivalent to

[1] https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf

halving over about 200 years), *result in no additional warming*.
• Faster reductions in methane emissions (> 10% over 30 years) can, theoretically, lead to cooling, as total CH4 gradually declines. Reductions in CH4 emission rates thus present an opportunity for agriculture to compensate for delays in reducing CO2 and N2O emissions.
• Negative GHG emissions become possible through reducing SLCP emission *rates*; a policy intervention that permanently reduces an SLCP emission *rate* corresponds, in terms of its impact on future temperatures, to active removal of a given amount of CO2 from the atmosphere (Allen et al 2018b).

Draft figure ES1 shows dairy cow numbers (and thus relative enteric emissions) and manure methane emissions in CA have been in decline, and are projected to continue to decline through 2030. Using GWP* to reassess the reductions in methane emissions achieved to date, this suggests that *CA dairy has already achieved negative warming potential (Allen et al 2018).*



To be clear, we are not arguing against State support for biogenic methane reduction and utilization projects where the scale of existing biogenic methane generation and availability of appropriate technology makes such utilization possible. We agree that "Replacing fossil natural gas with upgraded dairy biogas (biomethane) or other (biomethane) alternatives is important for California's longer-term climate goals," and support efforts to do so whenever appropriate. The question of displacing fossil fuel use, however, must be separated from the quantification of the GWP of dairy emissions, and the IPCC accounting methodology currently used by CARB to evaluate such projects is flawed for at least two reasons:

1) Estimation of the warming potential of dairy methane is overestimated by current IPCC methodologies, as noted above;
2) Actual social and economic costs of fossil natural gas are grossly underestimated due to externalization of real costs of fossil methane extraction, transportation and use, including catastrophic climate change.

Nitrous Oxide

The Draft largely ignores the nexus between manure methane and potential nitrous oxide emission avoidance. The use of nitrogen fertilizers is the primary driver of nitrous oxide (N_2O) and NO_X emissions from agricultural land (IPCC 2006). Inorganic N fertilizer use is responsible for the largest fraction of new N introduced into California's environment each year. Annual sales of industrial N fertilizers in California have surpassed 600,000 tons in recent years, while dairy manure application adds about one-third that amount of N to soils each year (Rosenstock et al 2013).

Providing incentives for agronomic utilization (rather than merely land disposal) of manures and manure-based aerobic composts in lieu of industrial fertilizers would go a long way toward reducing methane emissions and avoiding significant N_2O emissions while helping to retain and sequester organic C in soils, with attendant water, soil and air quality benefits. We urge ARB to engage with Cal Recycle, CDFA and the agricultural industry to develop a state-level strategy for linking organic "waste" materials (manures, urban organics, food wastes, processing wastes, biosolids, etc.), to nutrient demand by cropping systems across the state, including processing of these materials via anaerobic digestion and aerobic composting. Such a program can displace a significant percentage of both methane production from anaerobic waste materials and N_2O -producing industrial fertilizer use in the state and alleviate ongoing ground and surface water nitrate contamination, with the potential for enormous long-term environmental and economic co-benefits, including enhanced drought resilience for CA agriculture.

AMMP is undervalued

CARB's analysis appears to favor digesters over AMMP projects (ES-4). At the same time, because the multiple potential methane, carbon dioxide and nitrous oxide reduction benefits of AMMP projects are not quantified, AMMP benefits are underestimated (or not estimated at all!) with respect to net GHG reduction potential. In addition to the direct methane reductions achieved by AMMP projects, these benefits include: potential nitrous oxide reductions associated with nitrogen fertilizer avoidance; methane avoidance via organics diversion at the State scale; potential methane oxidation by soil methanotrophs associated with pastured livestock (Wang et al 2014); the short methane-hydroxyl-CO2 cycle of biogenic methane (Mitloehner et al 2020[2]); carbon sequestration benefits of soil organic amendment use in lieu of synthetic fertilizers[3], and carbon-focused grazing systems (Byrnes et al 2018, Stanley et al 2018, Rotz et al 2009). In addition are water quality and soil water holding capacity benefits associated with AMMP projects, as noted – though not quantified- in the Draft. As further noted in the Draft, AMMP projects may result in production of a product (compost) that can be cost effectively transported to replace chemical fertilizer use across the State:

[2] https://clear.ucdavis.edu/sites/g/files/dgvnsk7876/files/inline-files/CLEAR-Center-Methane-Cows-Climate-Change-Sep-2-20_6.pdf

[3]https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/calrecycle_organics_finalqm_6-15-20.pdf

> "Similarly, dairy-based organic fertilizers avoid the upstream GHG emissions resulting from manufacture and distribution of synthetic, fossil-based fertilizers. Market maturation would offer more opportunity to export nutrient-rich manure solids and reduce potential for water quality impacts from land application of manure. These benefits may be especially important in the San Joaquin Valley, where representative groundwater monitoring shows widespread water quality impacts."

GHG benefits of such displacement of synthetic fertilizers can and should be quantified [4], [5].

The Draft states (ES-3), "There has been limited progress in overcoming technical barriers to alternative manure management practices because resultant emissions reductions are inconsistent across the same project types and difficult to quantify." Actual technical barriers to AMMP lie not in the practices, which are well understood and have been deployed for decades, but in the capacity to quantify their emission reduction benefits. This is an important distinction, as technical barriers to practice deployment are few, while CARB is uniquely positioned to address any gaps in AMMP quantification methodology.

Feed Additives

The Draft states, (P. 5) "…no scientifically proven enteric emissions mitigation strategies are currently commercially available…Some novel additives…have also shown emissions reduction potential but lack sufficient in vivo studies to demonstrate long-term effectiveness….." Consequently, "For simplicity, the target-based funding scenario assumes that no enteric strategy will be available before 2030."

While we agree there has been limited progress in overcoming both technical and market barriers to enteric reductions "because no feed additives …are commercially available," we also note recent work cited in the Draft[6], and more recent work[7], showing clear benefits from several such feed additives, and the high probability that one or more of these materials will be approved for commercial use well before 2030. Enteric methane emissions represent an energy loss of up to 11% of dietary energy consumption[8], suggesting reducing enteric methane emissions can improve agricultural productivity, offering a clear incentive for producer utilization of effective feed additives and supporting arguments for producer education and incentives rather than imposition of a regulatory framework to encourage, not require, their use.

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[4] Foucherot and Bellassen 2011

[5] https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/calrecycle_organics_finalqm_6-15-20.pdf

[6] Mitloehner et al 2020; Machado et al 2015; Roque et al 2019.

[7] Roque BM, Venegas M, Kinley RD, de Nys R, Duarte TL, Yang X, et al. (2021) Red seaweed (Asparagopsis taxiformis) supplementation reduces enteric methane by over 80 percent in beef steers. PLoS ONE 16(3): e0247820. https://doi.org/10.1371/journal. pone.0247820

[8] Moraes LE, Strathe AB, Fadel JG, Casper DP, Kebreab E. Prediction of enteric methane emissions from cattle. Glob. Change Biol. 2014; 20(7):2140e2148. https://doi.org/10.1111/gcb.12471 PMID: 24259373

Statewide GHG Emissions

The Draft states (P1): "Through aggressive pursuit of regulatory and voluntary GHG emissions reduction measures across economic sectors, California GHG emissions fell below 1990 levels (431MMT) in 2016 (429/431), 2017 (424/431), and 2018 (425/431)." Unfortunately, this optimistic assessment is incorrect. Wildfire emissions meant CA exceeded 1990 GHG emissions in every one of those years[9], and, despite significant reductions in GHG emissions due to Covid-19 impacts[10], CA failed to meet its 2020 goal of 431 MMT. In 2020 alone, wildfires burned some 4.4 million California acres, emitting an estimated 112 MMT CO2. Black carbon is a potent SLCP with 900 times the 100-year GWP of CO2 (CARB NWL draft plan 2019, IPCC 2013[11]), and was not included in CARB's wildfire CO2 emissions analysis. While CARB has elected not to include wildfire emissions in its GHG inventory, this glosses over the actual state of CA GHG emissions, and contributes to an inflated assessment of the GWP impacts of the dairy and other livestock sectors relative to the state's overall emissions.

Conclusion

Our comments should not be interpreted to mean the dairy and livestock sectors do not need additional public funding to address GHG and other environmental concerns. While the GWP of methane is overestimated by the methodology deployed, the social and environmental cost savings remain, due to increased cooling (net negative CO2e) associated with ongoing reductions in total methane emissions over time. Absent public funding, however, additional projects with the potential to drive global cooling (and thus offset other sectors' GHG emissions) are much less likely to occur. Thus, a strong argument for continued public funding of these projects remains. We support continued incentives for methane digester and AMMP programs, particularly composting, and we urge incentives for significant reductions in synthetic nitrogen fertilizer use in favor of increased use of organics, particularly in the form of compost and composted manures.

We support CARB's efforts to improve quantification of methane emissions reductions from manure management projects and refinements of GHG emissions accounting for the sector, and would specifically like to see errors pertaining to the GWP of biogenic methane corrected in the Draft per Allen et al (2018). We would also like to see actual GHG emissions, including wildfire emissions of CO2 and black carbon, included in state emission assessments used to evaluate the relative impacts of agriculture. Finally, the Carbon Cycle Institute urges CARB to avoid a regulatory approach to advancing sector compliance, using incentives and collaborative efforts with livestock producers to ensure the sector can generate the needed activities and outcomes.

[9] https://ww3.arb.ca.gov/cc/inventory/pubs/ca_wildfire_co2_emissions_estimates.pdf
[10] https://www.nature.com/articles/s41558-021-01001-0.pdf
[11] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

Thank you again for the opportunity to comment on the Draft CARB Analysis of Progress toward Achieving the 2030 Dairy and Livestock Sector Methane Emissions Target.

Sincerely,

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