**Upstream Avoided Emissions Impacts for Biofuels**

**31 October 2024**

**Question for TAG Consideration:**

Should upstream avoided emissions impacts that occur during feedstock preparation or fuel production steps be recognized in the Clean Heat program’s lifecycle analyses of eligible biofuels?

**Background:**

The Vermont Clean Heat Standard (CHS) is required to include a framework for assessing the lifecycle greenhouse gas (GHG) impacts of the various resources which generate clean heat credits for program compliance. For biofuels, it is standard for such lifecycle assessments to include the upstream GHG impacts that occur during all aspects of energy production. This includes feedstock preparation, fuel production, and transport.

During the CHS development process there has been extensive consideration regarding the inclusion of the upstream emissions impacts—often referred to as “counterfactual” emissions impacts—as part of the program’s lifecycle assessment framework. These impacts typically occur during the feedstock preparation or fuel production steps and are limited to certain feedstocks and technological pathways. The most common example is avoided methane emissions in the organic waste and livestock sectors that result from the capture and use of those emissions for productive purposes.

This document summarizes the main arguments in favor of and opposed to recognizing these upstream emissions impacts associated with biofuels within the CHS’s lifecycle assessment framework. This document does not resolve any differences between the positions on matters of statutory interpretation, policy, analytical methods, and underlying facts.

**Relevant Statutory Language:**

30 V.S.A. § 8127 (g) Emissions Schedule.

(2) For each fuel pathway, the schedule shall account for greenhouse gas emissions from biogenic and geologic sources, including fugitive emissions and loss of stored carbon. In determining the baseline emission rates for clean heat measures that are fuels, emissions baselines shall fully account for methane emissions reductions or captures already occurring, or expected to occur, for each fuel pathway as a result of local, State, or federal legal requirements that have been enacted or adopted that reduce greenhouse gas emissions.”

30 V.S.A. § 8127 (j) Delivery in Vermont. Clean heat credits shall be earned only in proportion to the deemed or measured thermal sector greenhouse gas emission reductions achieved by a clean heat measure delivered in Vermont. Other emissions offsets, wherever located, shall not be eligible measures.”

**Discussion**

Arguments favoring recognition of upstream emissions associated with biofuels feedstock preparation or production steps impacts include the following:

* Anaerobic digestion of manure and organic waste consumes/destroys volatile solids that if stored/managed in an anerobic environment would otherwise produce methane. Therefore, production of biogas/RNG from manure/organic wastes avoids methane emissions when baseline management of those wastes produces methane.
* All other state-level portfolio standard-style programs which include lifecycle emissions assessments for biofuels also include counterfactual emissions impacts. With this in mind, exclusion of counterfactuals in Vermont would cause the CHS to lack the same price signals that attract the lowest carbon-intensity biofuel, potentially making Vermont less competitive as a destination for biofuels emissions reduction pathways.
* Reconciliation of program-based lifecycle carbon accounting and state-level inventories has been accomplished in other states for a number of years. Analogous precedent can be seen in California, Oregon, and Washington. Note that this must occur in Vermont regardless of whether counterfactuals are included.
* Program targets (i.e., the rate of decline of the cap) must be adjusted to preemptively account for expected lifecycle emissions from biofuels, which can include estimates for counterfactuals.
* Given the urgency of the climate crisis, a secondary goal to reducing emissions in the thermal sector should be to incentivize as many GHG reductions as possible. Doing so is implied by the use of lifecycle carbon intensity scoring within the CHS. Including counterfactuals for methane avoidance is a significant lever for doing so.
* Providing value for upstream methane avoidance related to fuel production will provide an important pathway for Vermont dairy farmers to reduce their emissions. This should be an important consideration given the prominence of Vermont’s dairy industry in the state and its vulnerability to climate change and out-of-state competition.
* Diversion of organic waste away from landfills as a feedstock for anaerobic digestion is a primary biogas/RNG production pathway with a volumetric and emissions reduction potential far greater than animal manure. This pathway is growing in prominence within North America and has allowed sustainability leaders like Denmark to achieve a landfill rate of less than 10% (some estimates show under 1%). Inclusion of the avoided methane benefits when assessing the lifecycle carbon intensity of such pathways will result in a carbon intensity score that values food waste diversion over landfilling. Exclusion of this counterfactual will treat landfilling and organic waste diversion the same. At this stage the act of landfilling remains less costly than organic waste diversion, meaning that the CHS will almost certainly select RNG derived from business-as-usual landfilling practices as the lowest hanging fruit, foregoing a significant opportunity to reduce methane emissions and improve the broader environmental impacts of organic waste disposal.
* Avoided methane emissions continue to remain a component of lifecycle assessment for RNG pathways in the GREET model according to updates by Argonne in 2024. Most recently, Argonne's September 2024 presentation[[1]](#footnote-2) shows updated values for RNG after a year-long literature review of "state-level manure management data" (slide 10). R&D GREET values remain inclusive of avoided methane crediting (slide 13).
* State-level implementation of the Clean Water Act (including in Vermont) often results in large farms being required to have long term (e.g., >180 days) manure storage capacity, in order to remain in compliance with state level waste management permits. The primary purpose of these mandates is to mitigate adverse water quality impacts associated with manure spreading by requiring farms to spread manure at times that will not result in substantial run-off (e.g., when ground isn't frozen).  As a result, large farms need large manure storage facilities (i.e., lagoons) to comply with permitting requirements and manure methane is often an in-direct consequence of otherwise well-intentioned state and federal policy. Like most businesses, farms need a business case to make substantial investments in sustainability improvements, including methane reduction. The financial incentives provided by clean and low-carbon fuel programs that include avoided methane crediting have proven effective at providing that business case to farms across the US, as evidenced by the growth of the number of anaerobic digesters on farms since implementation of such programs.
* As other jurisdictions have done, a CHS regulation could be written to cease crediting avoided methane emissions in the event that regulations are implemented in Vermont that require farms to reduce their manure methane emissions because such a regulation would make them no longer additional to business-as-usual. For example, the CARB LCFS regulation allows avoided methane crediting that is voluntary but in the event of a mandate the project would not be able to claim avoided methane reductions in subsequent crediting periods.[[2]](#footnote-3)

Arguments for excluding the counterfactual emissions impacts of eligible fuels from the Clean Heat program’s lifecycle analyses include the following:

* Act 18 explicitly requires that the CI phase-out account for the specific fuel pathway, which includes feedstock generation. However, as a matter of LCA boundary-setting, if the scope will recognize the benefits of avoided methane emissions, it should also account for other upstream emissions associated with the facilities and sources that produce the methane in the first place. For example, emissions from land-use changes (LUC), while sometimes indirect/induced, are caused by the existence of the biofuel: but for that biofuel, land use change would not have happened. Related to avoided methane, if the emissions from the manure lagoon are accounted for and credited to the CI, then it would also be appropriate to account for the other emissions associated with the agricultural operations. LCA standards would do this through the process of co-product credit accounting. Generally, the first step would be to consider whether the manure is a waste from the agricultural operation or a co-product. While LCA standards typically don’t apply upstream emissions to recycled waste products, if the manure were considered a co-product, then LCA standards would allocate a portion of the upstream emissions to the manure. In the case of dairy manure the other primary co-products from the farm would likely be milk and meat. The appropriate portion of upstream emissions allocated to each would be determined through the process of co-product credit allocation.
* Including negative carbon-intensity scores could have a distortionary impact on the CHS program. If the CHS program credits emissions from avoided methane, including out-of-state (or at least out-of-sector) avoided methane, but those emissions reductions don’t show up in Vermont’s GHG inventory for the thermal sector, then the CHS program might need to compensate in some way for creating clean heat credits that are not associated with Inventory emissions reductions. Requiring greater overall emissions reductions to compensate for some of those reductions not showing up in the Vermont GHG inventory could lead to higher costs for Vermont customers.
* Including negative carbon intensities for avoided methane could make electrification and weatherization pathways less competitive with RNG, even though those measures are more directly tied to Vermont’s thermal sector emissions than avoided methane releases from agriculture.
* To the extent that the CHS program allows crediting for avoided emissions, the counterfactual case should be CO2 rather than CH4 emissions:
  + There is an active debate about whether it is appropriate to assume that animal management systems are allowed to vent methane to the atmosphere. If these systems were required to reduce their methane emissions (e.g. through covered lagoon digesters) and the resulting biogas was flared to destroy the methane, which is technically feasible where RNG production occurs, then the methane would be converted to CO2 emissions, reducing its warming impact. In this case, the counterfactual scenario would be CO2 rather than CH4 emissions, resulting in less negative and potentially positive carbon intensities. A recent report from Argonne National Labs indicates that the GREET team is considering whether to change its assumptions about how to characterize counterfactual emissions from manure management systems to address this issue.[[3]](#footnote-4)
  + Paying methane producers for their waste methane in effect pays polluters for producing pollution. As we think about aligning overall policy objectives with climate targets, it is likely that regulation will eventually be needed to require basic controls on pollution sources where it is technically feasible to do so, for example by requiring methane flaring at manure lagoons and landfills. However, if RNG facilities encode their right to emit methane in order to be paid for clean heat credits, they will have an incentive to oppose future methane regulations that would reduce their funding.

1. Ou, Logwen, Hao Cai, Michael Wang, “Life-Cycle Greenhous Gas Results of Fuels from Waste Streams and Biomass with the R&D GREET Model,” Argonne National Laboratory, September 11, 2024, at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.gti.energy/wp-content/uploads/2024/09/39-tcbiomass2024-Presentation-Longwen-Ou.pdf. [↑](#footnote-ref-2)
2. CARB LCFS regulation Section 95488.9(f). Pg. 143. Available at: https://ww2.arb.ca.gov/sites/default/files/2020-07/2020\_lcfs\_fro\_oal-approved\_unofficial\_06302020.pdf. [↑](#footnote-ref-3)
3. Argonne National Laboratory, “Summary of Expansions and Updates in R&D GREET® 2023,” Section 2.1.4, December 2023, pages 5-6, at <https://www.osti.gov/servlets/purl/2278803>. [↑](#footnote-ref-4)