Hammerschlag LLC

MEMO

Subject: **Comments regarding proposed new *Tier 1 Simplified Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure***

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Background

On June 20, 2023 the California Air Resources Board ("CARB") issued a proposed new *Tier 1 Simplified Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure* ("the Calculator") and invited public comments. Hammerschlag LLC is a consultant offering services regarding life-cycle assessment of fuels. As such, Hammerschlag LLC is frequently assisting clients with California Low Carbon Fuel Standard (LCFS) pathway applications, including applications that utilize the Calculator.

CARB's proposed improvements to this frequently-used tool are welcome. With the comments below, we hope to refine the proposed improvements even further toward efficient pathway application processes under the upcoming CA-GREET 4 framework.

Rename 'Manure-to-Biogas (LOP Inputs)'

The tab 'Manure-to-Biogas (LOP Inputs)' appears in the CA-GREET 3 edition of the *Tier 1 Simplified Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure*; the tab name remains unchanged in the proposed, CA-GREET 4 edition. Regulators, applicants, and other stakeholders discussing the CA-GREET 3 edition tire of repeatedly writing 'Manure-to-Biogas (LOP Inputs)' when referencing cells on that sheet. Hammerschlag LLC recommends adopting a shorter name for tab 'Manure-to-Biogas (LOP Inputs)'.

Correct Label and Units for Field L4.7

The formulae in Field L4.7 compute **methane potential of VS to effluent ponds**, not "Volatile Solids to Effluent Ponds." The field units are m^3CH_4/day, not kg/day. Hammerschlag LLC recommends correcting Field L4.7 labels to match the field's function in the Calculator.

Characterize Methane Density as a CA-GREET 4.0 Input

The hard-coded number "0.68" appears, without associated documentation, in 157 formulae throughout sheet 'Manure-to-Biogas (LOP Inputs)'. Specifically in cells:

- 'Manure-to-Biogas (LOP Inputs)'!D47:I47
- 'Manure-to-Biogas (LOP Inputs)'!D106:I106
- 'Manure-to-Biogas (LOP Inputs)'!IK83
- 'Manure-to-Biogas (LOP Inputs)'!N9:N32
- 'Manure-to-Biogas (LOP Inputs)'!AB9:AB32
- 'Manure-to-Biogas (LOP Inputs)'!AP9:AP32
- 'Manure-to-Biogas (LOP Inputs)'!BD9:BD32
- 'Manure-to-Biogas (LOP Inputs)'!BR9:BR32
- 'Manure-to-Biogas (LOP Inputs)'!CF9:CF32

Context implies that "0.68" represents the density of gaseous methane in units of kg/m^3. Hammerschlag LLC recommends that this number be characterized as a CA-GREET 4.0 input through a formulaic link to cell Reference!E16. Reference!E16 contains CA-GREET 4.0 density of methane in g/ft^3. For example, the Microsoft Excel formula **`=Reference!E16*Reference!B30*Reference!B40`** produces the result 0.68 kg/m^3.

Simplify Baseline Period Input

For any reasonably imaginable application, Fields L1.x.7, where "x" is any integer from 2 to 6 inclusive, will have identical values to Field L1.1.7 "Calendar Days of the Month." Likewise, Fields L1.x.9 will have identical values to Field L1.1.9 "Average Temperature." Hammerschlag LLC recommends that yellow-shaded User Input cells in Fields L1.x.7 and L1.x.9 be replaced with grey-shaded Calculated Value cells referring to user input in Fields L1.1.7 and L1.1.9, respectively.

Simplify Baseline Period References

We are happy to see CARB restrict the baseline duration to either 12 or 24 months utilizing the new field L1.1.2 "Baseline Reporting Period (Months)," and the associated check thereof in cell 'Manure-to-Biogas (LOP Inputs)'!N33. This provides an opportunity to make the workbook more robust by eliminating instances of Microsoft Excel **COUNT** and **COUNTIF** functions. Hammerschlag LLC recommends doing so with the following set of changes:

cell	CARB proposed formula	Hammerschlag LLC proposed formula
'Avoided Emissions'!C32	`=IFERROR(SUM(C8:C31)/COUNTIF('Manure-to-Biogas (LOP Inputs)'!C9:C32, ">0")+'Manure-to-Biogas (LOP Inputs)'!J47/COUNT('Manure-to-Biogas (LOP Inputs)'!C9:C32), 0)`	`=IFERROR((SUM(C8:C31)+'Manure-to-Biogas (LOP Inputs)'!J47)/'Manure-to-Biogas (LOP Inputs)'!B9, 0)`
'Avoided Emissions'!E32	`=IFERROR('Manure-to-Biogas (LOP Inputs)'!K83/COUNT('Manure-to-Biogas (LOP Inputs)'!C9:C32),0)`	`=IFERROR('Manure-to-Biogas (LOP Inputs)'!K83/'Manure-to-Biogas (LOP Inputs)'!B9,0)`
'Avoided Emissions'!F32	`=IFERROR('Manure-to-Biogas (LOP Inputs)'!J107/COUNT('Manure-to-Biogas (LOP Inputs)'!C9:C32),0)`	`=IFERROR('Manure-to-Biogas (LOP Inputs)'!J107/'Manure-to-Biogas (LOP Inputs)'!B9,0)`

Rationalize Project Period Input

Project period input is hindered by three compounding issues.

First, it is counterintuitive that project period months must be entered in tab 'Manure-to-Biogas (LOP Inputs)' Field L3.1, in the Venting Events table that is not even used in quite a few applications. A first-time user's intuition is likely to suggest that project period months be entered along with the rest of the primary project data appearing in Section 2 of tab 'Biogas-to-RNG'.

Second, the calculation of project period length is difficult for a user to find or verify. It is calculated independently five different times using the term `COUNTIF('Manure-to-Biogas (LOP Inputs)'!B53:B76,">0")` within the formulae of cells 'Avoided Emissions'!D32, 'Avoided Emissions'!G32, 'Avoided Emissions'!C37, 'Avoided Emissions'!C38, and 'Avoided Emissions'!C39.

Finally, the calculated length of the project period is fickle, depending strongly on the user's input habits. The user enters project period months in three or more of cells 'Manure-to-Biogas (LOP Inputs)'!B53:B76. These entries must be recognized by Excel and its underlying operating system as a date, in order to be counted by the formula term `COUNTIF('Manure-to-Biogas (LOP Inputs)'!B53:B76,">0")`. For example, if a user enters "February" Excel will treat this as a text string and the month will not be counted. Worse, if Excel is operating in a Windows environment with a hyphenated default date format (YYYY-MM-DD) then entering dates following "MM/YYYY" as prescribed in the Field L3.1 column heading will also result in text strings uncounted by `COUNTIF`.

Hammerschlag LLC recommends rationalizing project period input with the following changes:

1. Require user input of reporting months at Field 2.3 ('Biogas-to-RNG'!B28:B51), and replace yellow-shaded User Input cells at Field L3.1 with grey-shaded Calculated Value references to Field 2.3. This places project period entry in an intuitive location.
2. Compute the length of the project period in a dedicated and labeled cell containing the formula `=COUNTA(B28:B51)`. The function `COUNTA` counts non-blank cells, removing the sensitivity to date formatting. Furthermore, the dedicated and labeled cell will allow the user to instantly detect any miscalculation of project period length.
3. In each of the cells 'Avoided Emissions'!D32, 'Avoided Emissions'!G32, 'Avoided Emissions'!C37, 'Avoided Emissions'!C38, and 'Avoided Emissions'!C39 replace the formulaic term `COUNTIF('Manure-to-Biogas (LOP Inputs)'!B53:B76,">0")` with a reference to the dedicated cell containing project period length. This improves both workbook robustness and workbook tractability.

Allow Non-Flare Combustion of Biogas

The proposed calculator includes two new fields 2.6 "Flared Biogas Flow" and 2.7 "Biomethane Content" reporting generated biogas that is combusted outside the fuel system boundary. CO_2

emissions due to this combustion are excluded from the CI, but there is no reason that that exclusion should be tied to the *purpose* of combustion. Whether undelivered methane is flared or combusted for some other purpose (*e.g.* powering farm equipment), the impact to the GHG balance is the same.[1] Hammerschlag LLC recommends labeling field 2.6 "Diverted & combusted biogas flow" and changing cell E25 to read "Diverted & combusted biogas."

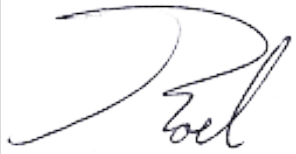
Omit Biogenic CO_2 from CI Computation

The Calculator and the *Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Organic Waste* are the only simplified Tier 1 calculators that burden the applicant with tailpipe CO_2 emissions, even though the carbon contained in the finished fuel was of biogenic origin. This contradicts the treatment of biogenic CO_2 emissions in other Tier 1 Simplified CI calculators, where they are simply omitted from the CI numerator.

Furthermore, in the primary CA-GREET model, biogenic CO_2 is offset with a credit for crop regrowth, for every biogenic fuel in the model.[2] We know of no legal or scientific basis for treating the biogenic CO_2 emitted by combustion of digester RNG, differently from the biogenic CO_2 emitted by combustion of any other LCFS-qualifying fuel. Since the primary CA-GREET model does not imply any such differentiation either, consistency would seem to demand changing values of cells Reference!B61 (tailpipe CO_2 emissions from CNG or L-CNG) and Reference!D61 (tailpipe CO_2 emissions from LNG) to 0.00 g/mmBtu.

Note that this change would also be more consistent with the exclusion of CO_2 emissions from biogas combusted outside the system boundary (including flared biogas reported in new fields 2.6 and 2.7).

Respectfully submitted,



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[1] Or better, if the purpose displaces a fossil fuel.

[2] In CA-GREET 3 the biogenic CO_2 credits are computed in row 82 of tab 'Vehicles,' in units of grams per vehicle mile.