California Business Ventures

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February 19, 2024

Clerks' Office
California Air Resources Board
1001 I Street
Sacramento, California 95814

Re: Comments on Proposed Low Carbon Fuel Standard Amendments

Electronic Submission

Dear California Air Resources Board:

The attachment to this letter constitutes my comments on CARB's Proposed Low Carbon Fuel Standard Amendment (lcfs2024) in response to the Request for Comments solicited on December 19, 2023.

My comments focus on four areas related to the computation of Carbon Intensity ("CI") values using the CA-GREET models and suggestions to enhance the value of the Current Pathways Database. Specifically, these include the following:

1. Ability to independently replicate computation of the Carbon Intensity (CI) values using the CA-GREET models relative to published Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways.
2. Insufficient identification of source data.
3. Prospective inconsistencies in statistical methods used to compute CI values.
4. Comparable use of emission factors.
5. Suggestions to enhance the value of the Current Pathways Database.

For the public, fuel producers, and fuel users to have confidence in the LCFS process, it is essential to have consistent and transparent computation of CIs. Such attention will aid CARB in tracking progress on attaining state goals, assuring compliance and help fuel producers and users make informed investment and selection decisions.

Thank you for the opportunity to comment on the proposed amendments.

Sincerely,

Barry R. Sedlik

Attachment

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COMMENTS OF BARRY R. SEDLIK REGARDING PROPOSED LOW CARBON FUEL STANDARD 2024 AMENDMENTS

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I address each of these items briefly below.

1. **Ability to independently replicate computation of the Carbon Intensity (CI) values using the CA-GREET models relative to published Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways.** After a concerted effort to use either the CA-GREET3.0 or CA-GREET4.0 models downloaded from the CARB's LCFS website, I was unable to replicate the computation of the CI's presented in the "Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways" document posted on January 23, 2024. I believe there are several reasons for this:
    a. Both the CA-GREET3.0 and CA-GREET 4.0 models have an incomplete and inconsistent indexing process to map various regions with their respective technology and emission factors. The original GREET model used the 10-region North American Electric Reliability Corporation ("NERC") breakdown to define regional characteristics regarding electric system technology configurations and operations. The GREET models later adopted the finer-grained USEPA, eGRID region map that contains 26 subregions. In neither the 3.0 nor 4.0 models are data mapped correctly. There appears to be no eGRID specific data in either version, but the model reverts to a table containing only the 10 NERC region data. In addition, when specifying "User Defined" data elements, the indexing mechanism selects NERC Region 2 data, which reflect data for NERC Region ASCC, the Alaska Systems Coordinating Council. This error is significant as it is not clear to the user that User Defined data are being used in the computations.
    b. On a related matter, the GREET4.0 model contains a table of factors on a state basis, but there is no means to access that table directly. It appears that a user would have to cut and paste the state-specific data into the NERC ASCC column of Alaska factors and relabel in order to use that data. The same applies to entering California specific data as provided in the Annual Update document.

c. With respect to the Lookup Table Pathways document, the text states that "Feedstock Production" is computed from the "U.S Average Mix" (page 4). However, in the various computations of feedstock production CIs in the document (p9, p10, p11, p12, and p13), it appears that California rather than US average fuel mixes are used.
d. In the CA-GREET4.0 model, the separate pulldown menus for "Feedstock" and "Fuel" to calculate respective emissions from two regions has either been dropped or otherwise obscured. This is an important distinction as Feedstock emissions are computed on an U.S. Average basis and Fuel emissions from use are computed on a localized basis, e.g., California state. Without a clear distinction and labeling, a user of CA-GREET4.0 would otherwise have to compute results in two separate computation sets and independently add the results to compute the total.

As a consequence of the above errors and discrepancies, proper computation of CIs would require substantial independent analysis and validation. It is essential that these errors be corrected. In addition, future releases of the Annual Updates to Lookup Table Pathways should be accompanied with a populated data set of the proposed changes in the CA-GREET model so users can follow how the CIs are computed in the model.

2. **Insufficient identification of source data.** The CA-GREET3.0 and CA-GREET4.0 models have no internal documentation other than a few generic cell comments about the sources of the various data sets used by the model. Without such documentation, it is impossible to determine the source data for emission factors, efficiencies, fuel characteristics, resource mixes, technology mixes, etc. The problem is compounded as the model draws upon U.S.EPA date from its eGrid model and AP-42 emissions data, U.S. Energy Information Administration for its State Energy Data System ("SEDS"), the California Energy Commission for California generation data by fuel and source, as well as CARB's own Emission Factor ("EMFAC") database, among other sources.

As most of the data sources are compiled on an ongoing basis, it is also important to know the year or vintage of each to make sure that computations can be constructed on a consistent basis as well as to facilitate data validation.

Many of the data items in CA-GREET3.0 and CA-GREET4.0 appear to be cut and paste entries from other sources without appropriate attribution. While the Update document attempts to provide some source documentation, it is also incomplete. For example, in the current January 23, 2024 update, various references to Form EIA-923 data are made that state, "2022 Form EIA-2023 dataset for NG plants located in California [are being used whereas] in prior annual updates, the 2017 Form EIA-923 national dataset for NG plants was used." However, no such references are provided for data items used for oil, coal, or biomass. Were the oil, coal, and biomass data items similarly updated or are the 2017 data items still being used?

Another example of an inconsistent data item of substantial importance is the estimated electric system transmission and distribution losses. In the CA-GREET models, the loss factor is defined as 6.5 percent (Electric Sheet Cell D101). However, the US EPA eGRID 2022 database shows estimated average NERC WSCC Region (including California) and US wide T&D losses at 5.1 percent (eGRID2022,tab GGK22, Cells F7 and F8, respectively). There is no data source defined

for the 6.5% loss factor. Should the loss factor be in error, the higher loss factor contributes to an across the board increase in CIs for all electric production.

In the interests of transparency and data integrity, all data items within the CA-GREET model should have a definitive source and vintage embedded within the model. A separate reference page with complete citations with a corresponding entry for each data table or data item (e.g., T&D losses) would be a substantial improvement. In addition, the annual updates should apply equal rigor to data sources.

3. **Prospective inconsistencies in statistical methods used to compute CI values.** While there may be documentation that describes various motivations for using certain statistical and technical conventions within the CA-GREET model and its GREET model predecessor, I was unable to determine reasoning for a few items that may have modest or significant impact on the computation of CIs.

   With respect to statistical computations, two different methods are used to compute averages. In the Electric sheet for Power Plant Conversion Efficiencies for each technology within a fuel type, the average for the fuel type is calculated using a weighted harmonic mean. This appears to be consistent with good statistical practice that weighted harmonic mean determinations are appropriate when applied to rates as is the case with computations for Power Plant Energy Conversion Efficiency (e.g., Cells H60, H64, H69,and H72 on the Electric Sheet).

   However, when computing the average emission factors for each fuel based on the same relative proportion of technology types for the fuel, arithmetic weighted averages are used (e.g., Cell B107 on the Electric sheet and Cell B579).

   As both sets of computations deal with rates, it would be helpful to know if these disparate methods are intentional or an artifact of model construction. If an artifact, then appropriate reformulation of the calculations should be undertaken to maintain computational integrity. All mean calculations throughout the model should be examined and reformulated as required.

4. **Comparable use of emission factors.** The CA-GREET model provides several different sources to compute emission factors. Among these are computations from emission testing/monitoring of in-use combustion processes (e.g., oil-fired boilers, natural gas-fired combustion turbines, and IC engines) and theoretical computations based on the stoichiometric carbon content of the fuel of interest coupled with an estimate of the conversion efficiency of the corresponding technology. For example, it appears that US EPA's eGRID database uses emission factors based on actual prime mover performance whereas the CA-GREET model computes stochiometric-based emission factors (see CO2 Emission Factor in Cell B16 on EF Sheet).

   While it may be appropriate to use both emission factor methods to determine aggregate CO2e emission estimates for a particular fuel, there should be some discussion to maintain an "apples to apples" basis.

   Specifically, the operation of any fuel combustion prime mover whether steam-fired boiler, combustion turbine, or IC engine, requires excess air to reduce NOx formation and optimization of efficiency.

For a gas-fired steam boiler, optimal excess air is approximately 10 percent, for a natural gas-fired combustion turbine, the optimal excess air percentage is 10 percent to 15 percent, and for an IC engine driven genset, the excess air optimal range is approximately 10 percent to 30 percent

As the CO2 in atmospheric air is non-reactive in the combustion process but just passes through as part of the excess air mix, its presence in boiler, turbine, or engine exhaust is not derived from the carbon within the fuel.

Consequently, emission factors derived from exhaust measurements of combustion processes should be corrected to account for the portion of the non-reactive CO2 component of excess air in the CI computation.

5. **Suggestions to aid fuel users make informed decisions regarding fuel supplier selections.** At the end of the day, it would be desirable for California fuel users to access the posted Current Pathways database so they can make an informed decision regarding the CIs of available fuels to help them make an informed economic decision for the alternative fuel and technology that best meets their needs. That is not possible at the moment since fundamental fuel characteristics such as heat content and fuel density are not displayed in the Current Pathways database. Furthermore, it appears that fuel providers consider such information proprietary and redacted from most Application Packages. Consequently, rather than be able to conduct their own investigation of available fuel alternatives, fuel users need to rely on third party providers or direct contact with the producer to determine if a particular fuel will meet their needs.

   It is unclear why such basic information is considered proprietary. Disclosure of such fundamental characteristics would facilitate more efficient market performance.

   CARB should consider revising the current practice of withholding basic fuel specification as proprietary and encourage producers to post such information voluntarily.

This concludes my comments.

/s/

Barry R. Sedlik
California Business Ventures