January 7, 2022

Cheryl Laskowski
Branch Chief, Transportation Fuels Branch
Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Comments on December 7, 2021 Workshop on Potential Future Changes to the LCFS Program

Dear Ms. Laskowski,

The Brazilian Sugarcane Industry Association ("UNICA") appreciates the opportunity to provide comments on the California Air Resources Board's (CARB) potential future changes to the Low Carbon Fuel Standard (LCFS), which were presented and posted for comments on December 7, 2021. Given the timing of the workshop and the deadline for comments, the inputs UNICA present to you today are intended to be the starting point of a conversation that we hope to have with you throughout the new year and the regulatory process.

For the past decade, UNICA member companies have helped California meet the aggressive goals of the LCFS by providing volumes of advanced low-GHG-producing sugarcane ethanol. California remains the most important market for Brazilian sugarcane ethanol in the United States, the vast majority being used by California drivers.

As your presentation shows[1], ethanol use has fallen since the adoption of new 2019 LCFS regulations, despite being the biofuel with the highest number of certified pathways under your program.

We are pleased to take this opportunity to demonstrate how ethanol – particularly the sugarcane sector – can help CARB achieve its 2050 carbon neutrality goal and strengthen the program's pre-2030 targets.

1. Over the long term, the low carbon ethanol industry will continue to move the state away from fossil fuels by providing low and negative emission energy sources for new transportation fuels and mobility, including sustainable aviation fuels (SAF), zero emissions vehicles (ZEV) and hydrogen. Our sector is not static and sees great opportu-

[1] LCFS Workshop on 12/07/ 21 /Carb staff presentation – slides 6, 8: https://bit.ly/3Ekh8rt

nities to be part of the energy transition by continuously improving technology and production patterns.

2. In the short term, we can help accelerate the reduction of GHG and other harmful emissions (particularly PM. 2.5) by using the existing infrastructure and exporting advanced low carbon ethanol to California.

No other bioenergy source is as complete and efficient as sugarcane ethanol. Sugarcane is a semi-perennial crop, with one of the highest energy yields per hectare. As you know, our mills do not depend on external energy to produce biofuels. Departing from huge amounts of energy (in the juice, bagasse, tops, and leaves) per hectare, our technology platform is based on the circular economy and the use of residues in several different forms.

Regarding land use in Brazil, sugarcane accounts for less than 1% of the national territory and is far from deforestation hotspots, such as the Amazon. According to the EU-Joint Research Center study[2], there is very low correlation between indirect land use change (ILUC) and sugarcane expansion. Currently, sugarcane is the commercial technology with the highest energy yield per occupied area and it is entering a new era that focuses on using energy from sugarcane as a whole, which makes it possible to multiply production without the need for additional land. The main factors that would enable the expansion of sugarcane ethanol are an increase in sugarcane productivity in the field and increased use of agro-industrial waste: straw, bagasse, vinasse and filter cake, intended for the production of 2G ethanol, bioelectricity, and biomethane.

Also, our expansion has been mostly over degraded pastureland. We have observed a technological transformation in the existing areas where conventional harvesting has been substituted by green harvesting, with higher soil protection and other benefits. Both changes (in new and existing areas) lead to GHG uptake from the atmosphere to terrestrial carbon stocks.

With adequate market signals, the industry will continue to improve our production systems. We already produce 2nd generation ethanol, biogas, and electricity. In the future, our ethanol will be used to produce low-carbon aviation fuels and will also be the best way to transport low-carbon hydrogen. We also see significant opportunities for ethanol to be used as a stable energy storage, helping to diversify low CI sources of hydrogen or used in bio-electric low-carbon hybrid or fuel cell vehicles. This would help alleviate the negative impact of EV batteries on the environment and the inevitable pressure on electric grid.

As you rightly mentioned during the workshop, the LCFS has become a model not only for other states, but also for countries such as Brazil. Inspired by your program, Brazil created, in 2017, its own low carbon fuels standard, the RenovaBio. The program aims at reducing the carbon intensity of the Brazilian transportation matrix by increasing the use of renewable low-carbon fuels and

---

[2] https://publications.jrc.ec.europa.eu/repository/handle/JRC117364

by creating a carbon credit market to offset GHG emissions by fossil fuels. RenovaBio has even gone one step ahead and requires effective and verifiable agricultural data. We have learned a lot while building RenovaBio and we would appreciate the opportunity to share some of our learnings with your staff that might be helpful in further improving the LCFS program.

For today's comments, we would like to focus on a few items that we have discussed with CARB in the past, which we've divided in 2 categories:

- Those that significantly impact sugarcane CIs:
    1. Mechanization;
    2. Maritime Transportation;
    3. Registration of Multiple Logistic Routes;
    4. N2O Emissions from Soil;
    5. Emissions from Vinasse Dispersion;
    6. Electricity Export Credits;
    7. Soil Organic Carbon;
    8. Tier 2 Pathways;
- Necessary process improvements with less relevant impact over CIs:

9. Tier 1 Calculator Technical Problems;
10. Non-bagasse Biomass

We understand the list requires strategic planning in order to set our priorities, therefore we would like to propose to set up a working group and support CARB staff work through each of these items (more details below). We would also be delighted to further our conversation and share our thoughts and contributions on SAF, ZEV and Hydrogen. We would also like to contribute to the discussion raised during the workshop on the re-evaluation of land use change (LUC) carbon intensity values, and site-specific agricultural inputs. We look forward to engaging with you.

We are hopeful you will continue to count on Brazilian sugarcane ethanol to achieve energy transition to net zero. To achieve such a vision, we believe the suggested adjustments on the way sugarcane ethanol is currently treated under the LCFS program are necessary.

Updates in Tier 1 calculator

While we understand CARB staff wants to make the pathway registration process more efficient, we believe sugarcane ethanol continues to be unfairly

scored and the calculators need some fine-tuning. By fixing the problems we identify below, not only will CARB provide fair treatment for sugarcane ethanol but will allow more sources of low-carbon fuel to reach California ports and tanks cost-effectively.

In the pages below, we identify the most important problems with the CI calculator (Tier 1, specifically) scoring of sugarcane ethanol. We respectfully request that CARB staff carefully consider these comments as we believe these changes need to be implemented to help California accurately reflect the benefits of this low-carbon biofuel.

1- Mechanization

Mechanization has dramatically reduced emissions in sugarcane fields and mills should be recognized for this progress by being allowed to input site-specific mechanization data into the calculator. Brazilian biofuel producers who have made significant technological investments should not be penalized by lower default assumptions.

The investments in mechanization have helped the sugarcane sector reduce GHG emission from harvesting by 57%over the past 10 years (from 4.8 to 2.1 g CO_2eq/MJ of ethanol). Such improvement does not take into account improvements in Soil Carbon Stocks (SOC), which we detail further below.

In the CI calculator for sugarcane ethanol, CARB offers two default values for sugarcane mechanization for Brazil: 80 percent for São Paulo state and 65% for other states in the Center-South region. Although some UNICA members may opt for the default value, the vast majority of our members, especially those located in Sao Paulo, where nearly all harvesting is mechanized, would prefer to prove their operations are at highest levels of mechanization.

We again urge CARB to offer an option for self-declared mechanization percentage in the Tier 1 CI calculator. If for some reason this is not feasible, we respectfully ask staff to adjust the default mechanization values for Center-South Brazil to a value no lower than 85% and to São Paulo State to a value no lower than 95%. By doing so, CARB will be scoring input more closely to actual practice and will most likely avoid Tier 2 application requests from Brazilian mills, saving time and financial resources for both the Agency and the mills.

2 - Maritime Transportation

We remain very concerned that CARB staff continues to advocate for the inclusion of back-haul penalties for maritime transportation of sugarcane ethanol to California.

UNICA has not seen any data to support CARB's assertion that ocean tankers bringing ethanol fuel from Brazil to California will return empty to Brazil. CARB made clear that back-haul emission penalty is due to an overly conservative approach in case such empty (unlikely) return trips happen in the future so it can treat all biofuels fairly.

Different UNICA member companies have tracked and verified that the vessels that transport their fuel to California do not return empty to Brazil. One particular member company tracked and documented all 10 vessels that shipped their ethanol from Brazil to California during 2019. Every vessel was reloaded somewhere on the west coast or near California. This type of information is traceable, easily confirmed and verifiable.

The back-haul penalty unfairly imposed to sugarcane ethanol is significant, corresponding to nearly 46% of maritime emissions Excluding such a penalty would correct sugarcane carbon improving intensity score by 4.77 g CO2eq/MJ. Assuming the energy consumption and associated emissions of the ocean tanker's round trip be attributed to sugarcane ethanol is speculative and arbitrary. This approach causes a tremendous damage to sugarcane ethanol competitiveness in the California market.

We urge staff not to impose back-haul penalties on Brazilian sugarcane ethanol, since these penalties are not supported by data or shipping practices. Maritime logistics can be easily tracked, particularly now that the LCFS has third party verification.

3 - Registration of Multiple Logistic Routes

Due to the geographical location of Brazil and some methodological choices made by CARB, logistics represent an important share of sugarcane ethanol emissions in the LCFS. The Tier 1 calculator does not allow for a single mill to register more than one logistic route with different CIs. Due to this restriction, mills must register the most conservative logistical route.

As a result, there is no benefit to choosing the most optimized logistic with lower CI. This is an unnecessary burden for the LCFS program (and ultimately to Californians) and does not help to guide better decisions considering their environmental costs.

Further, we understand there is precedent of this pledge in the LCFS program. In at least one case, a single renewable diesel facility has different CIs depending on the origin of its feedstock. We would very much welcome the opportunity to engage in this discussion with staff.

As we mentioned above, maritime and onshore logistics can be easily tracked, particularly now that LCFS has third party verification. This also applies to pipeline logistics, which represents much lower emission levels than the direct alternative in Brazil (trucks) but not currently captured in the modeling.

4 - N2O Emissions from Soil

When it comes to estimating N2O emissions from farming, the GREET 3.0 Tier 1 calculator points to around 15% of the CI (gCO2eq/MJ) coming from N2O emissions from soils. It seems highly overvalued when compared to the numbers seen in the literature. In this example below, it represents 8,85 over a 55 gCO2eq/MJ sugarcane ethanol CI. Our impression is that such a high value comes from the amount trash of sugarcane straw considered in the CA-GREET

model. The existing value is about 30 to 40% higher than actual value. We would be glad to provide evidence in appropriate time.

In this sense, we suggest CARB review this assumption and adopt an evidence-based approach. It is also important to stress that it is not clear where this very conservative factor of N2O emissions from soils used in GREET 3.0 is coming from.

5 - CH4 Emissions from Vinasse Transportation

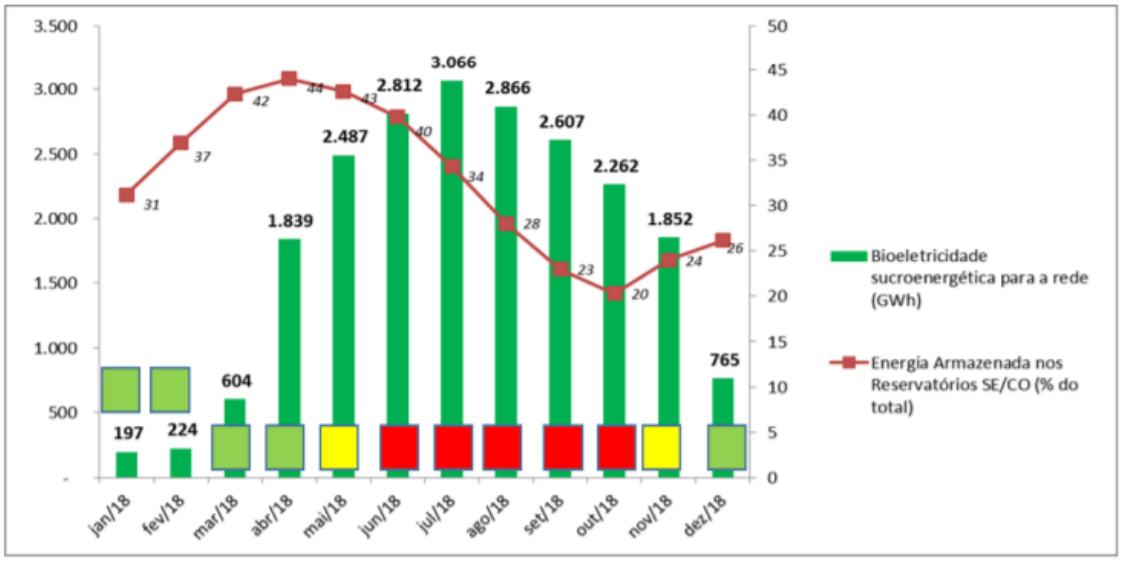
CA-GREET 3.0 considers CH4 and N2O emissions from open channel transportation of vinasse. Even though vinasse unlined tanks and open channels feature conditions that may lead to methane emissions (N2O emissions are very low), such transportation strategy does not reflect the average conditions of vinasse logistics in Brazil. Regulations of the state of São Paulo, for example, have established back in 2005 schedules for impermeabilization of vinasse tanks and channels. Furthermore, mills have also adopted systems based on closed tanks and pipes, which further reduce methane emissions during vinasse transportation. Therefore, we strongly recommend CARB to disregard CH4 and N2O emissions from open vinasse channels as a representative condition considered in CA-GREET.

6 - Electricity Export Credits

CARB is excluding export electricity credits generated in the off-season months from sugarcane ethanol CI calculations. Mills in Brazil have the option to store their own bagasse to produce electricity to be used in the off-season months to be exported to the grid, avoiding other more polluting sources from being tapped for energy. Brazilian sugarcane ethanol should not be penalized by this practice, and we urge CARB to reconsider this assumption and allow the use of these credits by Brazilian mills, especially considering that the calculator already backs out the electricity exports eventually generated from third party biomass, which excludes the possibility of gearing.

One important revision is the value of electricity credits kg CO2eq/MWh for sugarcane ethanol. The surplus electricity from sugarcane mills plays a fundamental role in the Brazilian electricity mix. Hydropower, which relies on water reservoirs and rainfall regimes, accounted for the majority of electricity production in Brazil. Hydroelectric environmental restrictions often push the electric system to other sources (such as natural gas or oil) with much higher cost amd emissions, but more reliability.

The periods of heaviest use of high-cost electricity sources are marked with “red flags.” as presented in figure 1. This occurs in the dry season (winter), when the reservoir levels of the hydroelectric plants are low, and the sugarcane harvesting is at his highest levels, avoiding the use of oil and natural gas power plants.



Bioeletricidade sucroenergética (GWh) ofertada para a rede, jan. a dez./2018 e Bandeira Tarifária no mês

Therefore, the correct assumption to calculate electricity credits in Brazil is using electricity at the margin (natural gas or oil). This approach was taken by CARB in the initial regulation and should be reinstated.

7 – Soil Organic Carbon (SOC)

We now have a far greater understanding of the changes in C stocks when climate-friendly management practices such no till, sugarcane green harvesting, pasture recovery and integrated systems are adopted. Most land use models (including the GTAP-AEZ_EF) had no time to incorporate those improvements, nor did the LCFS.

In areas previously occupied by sugarcane, changes in SOC for sugarcane depends on the harvesting technique. Sugarcane fields are replanted only after 5-6 years; thus “perennial crop” is a better representation than “long-term cultivated crop” for all harvesting techniques. In contrast to traditional manual harvesting systems (where cane used to be burned in the pre-harvest) green harvest system can uptake as much as 1.02 to 1.87 Mg C ha-1 year-1 in topsoil, when compared to areas under the traditional pre-harvest burning practices.

Additionally, new GIS evidence shows that most of the sugarcane expansion happened over severely degraded pastureland and that the conversion of those areas to sugarcane leads to an increase in SOC.
Those evidence should be incorporated in the LCFS update.

8 – Tier 2 Pathways

As mentioned previously, many of the points we discuss in this letter are contributions/ comments we have submitted in the past. We heard from staff

during our engagements, and also during a Board Meeting back in 2018[3], that CARB wanted to simplify the process and the Agency would be willing to entertain the exceptions in Tier 2 pathways. However, the experience of some of our mills who attempt to apply for Tier 2 pathways has been disappointing and this has become a problem for our industry.

We urge CARB staff to revisit the inconsistencies and errors in the Tier 1 calculator listed below, and simplify the Tier 2 registration process for mills that can prove significant improvement in their processes.

9 - Tier 1 Calculator Technical Problems

It was brought to our attention that the Tier 1 calculator continues to have some technical problems that may impact certification procedures, deadlines and CIs for Brazilian sugarcane ethanol pathways.

We request CARB staff consider these points made by some of our mills and make the necessary adjustments to correct them. UNICA is at CARB's disposal to help coordinate communication with mills, if necessary.

The points needing attention and adjustment are:

1 - Tier 1 problems impact pathway registration process and deadlines.

a) The units of measurement generate problems in the calculations and, consequently, the Tier 1 spreadsheet of most mills is indicated as having problem.

i. "Calculator! F83" and "Calculator! G83" cells are in Liters per ton but calculation generates result in Liter per ton short (907.18 kg). This problem can be solved by changing "Calculator! AN48" cell, from "0,00000110231" to "0,000001000000".

b) Misinterpretation of concepts leads to calculation problems

i. "Calculator! F81" and "Calculator! G81" cells treat sucrose as synonymous with fermentable sugar without proper adjustment to consider that only sucrose can be recovered as sugar production and that there is a chemical conversion factor of sucrose to fermentable sugar.

2 - Request for inadequate process parameter that compromises data validation process and information organization by plants: Following the exact data description of the following items may push the Tier1 calculator out of the optimization limits of the model leading to an error (model does not find a solution). Our mills can provide examples of such cases. Without a solved model, the certification process cannot start. On the other hand, not following the exact description may lead to invalidation of the pathway by the certification company.

a) The label of item 3.15: "Fraction Sucrose Entering Sugar Production (monthly weighted average) (4)" is leading to inconsistent interpretation and should be relabeled. A better representation would be: "ART content in sugarcane juice (after losses) divided by sugarcane crush". In the cells "Calculator! P35:

---

[3] CARB Board Meeting, September 27, 2018, pages 406-408: **https://www.arb.ca.gov/board/mt/2018/mt092718.pdf?_ga=2.268553393.1389444596.1641496685-105483836.1641496685**

P58", information on the ART content of the cane juice is requested to carry out calculations to validate the consistency of the data declared in the Tier 1 spreadsheet. However, this indicator is unusual in plant controls and, as a result, less reliable. We suggest that CARB adjust calculations to request information on the cane ART discounted from for industrial losses (CONSECANA-SP fixed factors could also be used instead of plant specific losses). This might require some adjustments on the restrictions of the existing "solver".

b) Still on cell G72, the model assumes that the quality (share of ART) that goes into sugar production is the same that goes into ethanol production. This incorrect assumption restricts the model and generates problems in cells F83 and G83. Cells O35:O58. Those cells require "Juice Allocated to Sugar Production (weighted average) (3)". However, this share should be calculated based on the share of ART that goes into sugar production, since ART concentration is significantly different in the juice that goes to sugar or ethanol production.

3 - Anhydrous ethanol production from hydrous redistill: In Brazil, the anhydrous ethanol is commonly produced from the dehydration of the hydrous ethanol in molecular sieves. It allows the mills to carry a 'transition storage' of hydrous ethanol from one season to the next. It causes two main issues in the Tier 1 calculator: 1-Anhydrous production during off-season months. 2-Monthly negative values for hydrous ethanol production due to the dehydration of the stored hydrous ethanol, causing a higher consumption of hydrous ethanol for anhydrous production than the new production of hydrous ethanol. In these cases, a solution could be to report only the primary product originated from the sugarcane juice: the hydrous ethanol.

4 - As an alternative approach for the final CI calculation, instead of having a CI for the molasses and another for the juice, it would be much simpler to allocate emissions of sugarcane production into sugar, ethanol and other co-products by the energy (or sugar) content of final products. This approach has been taken in the RenovaBio Program, leading to a much straightforward modeling and verification process.

10 – Non-bagasse Biomass

CARB already accepts on the calculator (item 3.8) non-bagasse biomasses such as sugarcane straw, rice husk, woodchips, and sawdust since they are converted into tons of bagasse equivalent (TBE). However, the conversion factors (LHV and moisture) are not clear. Since some biomasses are not included in CA-GREET 3.0 and the model does not have any moisture data, it would be better and faster for the certification process if the regulation provides standardized conversion factors for wood chips.

We believe ethanol will continue to be an important, affordable, and reliable tool to achieve the ambitious climate goals of California. We urge staff to consider and implement our suggestions and ensure sugarcane ethanol is fairly scored in the Tier 1 calculator, and that the certification process occur in a timely fashion, so the greater number of mills use Tier 1 to register their pathways and export their product to California.

As always, UNICA appreciates the opportunity to submit these comments and looks forward to discussing them in greater details in the coming weeks and months. We remain at staff's disposal to work on any aspect of our suggested modifications, or to provide any additional data from the current experiences and anticipated trends in Brazil.

Sincerely,

Leticia Phillips

Representative-North America

UNICA - Brazilian Sugarcane Industry Association

1666 Connecticut Ave NW | Suite 100 | Washington | D.C 20009

Phone: (202) 506-5299 | **www.sugarcane.org**