BRAZILIAN SUGARCANE INDUSTRY ASSOCIATION

ETHANOL • SUGAR • ELECTRICITY

August 30, 2018

Mary Nichols
Chairman
Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Second Public Availability of Modified Text and Availability of Additional Documents and Information for the Proposed Amendments to the Low Carbon Fuel Standard Regulation and to the Regulation on Commercialization of Alternative Diesel Fuels

Dear Chairman Nichols,

The Brazilian Sugarcane Industry Association ("UNICA") appreciates the opportunity to once again provide comments on the California Air Resources Board's proposed amendments to the LCFS, which were posted for comments on August 15th, 2018.

Brazil is the world's largest sugarcane producer and the second largest producer and exporter of ethanol with 22 percent of global production and 17 percent of exports in 2017.[1] Despite these volumes, sugarcane ethanol production uses only one percent of Brazil's territory[2] and has the potential to reduce lifecycle greenhouse gas ("GHG") emissions by more than 100 percent[3] compared to conventional gasoline. Brazil's innovative use of ethanol in transportation and biomass for power cogeneration has made sugarcane a leading source of renewable energy in Brazil, representing 17.5 percent of the country's total energy supply, ahead of hydroelectricity.[4] Brazil replaced nearly one-third of its gasoline needs with sugarcane ethanol last year.[5]

For almost a decade, UNICA member companies have been committed to helping CARB meet the goals of the LCFS by providing volumes of low-GHG-producing sugarcane ethanol. And UNICA technical representatives will remain available to CARB staff to continue supporting implementation of the LCFS.

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[1] Percentages calculated by UNICA, based on LMC Ethanol Monthly Update (March 2018).
[2] Brazilian Institute of Geography and Statistics ().
[3] Seabra, J. E. A., Macedo, I. C., Chum, H. L., Faroni, C. E. and Sarto, C. A. (2011), Life cycle assessment of Brazilian sugarcane products: GHG emissions and energy use. Biofuels, Bioprod. Bioref., 5: 519–532. doi:10.1002/bbb.289
[4] National Energy Balance – Base Year 2016 (2017).
[5] *Id.*

While we recognize the effort of staff to make the pathway registration process more efficient, we are concerned that sugarcane ethanol will not be scored accurately under the proposed changes. Given the short 15-day comment period, the comments below are not exhaustive. However, UNICA has attempted to identify some of the most important problems with the way the new CI calculator will score sugarcane ethanol. We respectfully request that the Board and ARB staff carefully consider these comments and also consider the letter of suggestions[6] UNICA delivered at the last Board meeting on April 23rd. In both documents, we believe we have included valuable and important suggestions that need to be implemented in order to help California accurately capture the reality of the sugarcane ethanol industry in Brazil and reap the benefits of this low carbon biofuel. **We urge you to take them into consideration before finalizing any adoption of amendments.**

In addition to the comments submitted on April 23rd, we would like to request the Board to carefully consider these five main issues related to the amendments to the Tier 1 simplified CI calculator for sugarcane-derived ethanol:

1- Mechanization

UNICA and its member companies are very concerned about the way the proposed simplified calculator would treat the mechanization input. Our members have made significant investments over the past decade to reduce emissions through the mechanization process, and they should be allowed to reap the benefit of this investment by inputting site-specific mechanization data into the calculator. When UNICA and its members companies began liaising with ARB staff on this issue, we understood that mills would either opt to use a default lower mechanization value and avoid verification, or mills would input their site-specific values and go through verification. These conversations evolved, and we submitted on April 23rd our suggested methodology for mechanization verification. Our July 5th comments[7] again urged CARB to include a site-specific mechanization input in the Tier 1 calculator. We later learned that CARB does not intending to include this input with the calculator. We urge ARB to reconsider this decision so that biofuel producers who have invested in modern (and expensive) technology are not penalized by lower default assumptions.

The South-Central region of Brazil—which is responsible for all the ethanol exported from Brazil to countries such as the United States, Japan and the European Union—has seen dramatic increases in mechanization over the last decade. According to the State-owned Brazilian Food Supply Company (CONAB in Portuguese), from the Brazilian Ministry of Agriculture, Livestock and Food Supply (MAPA), the South-Central region has reached 95.6% of

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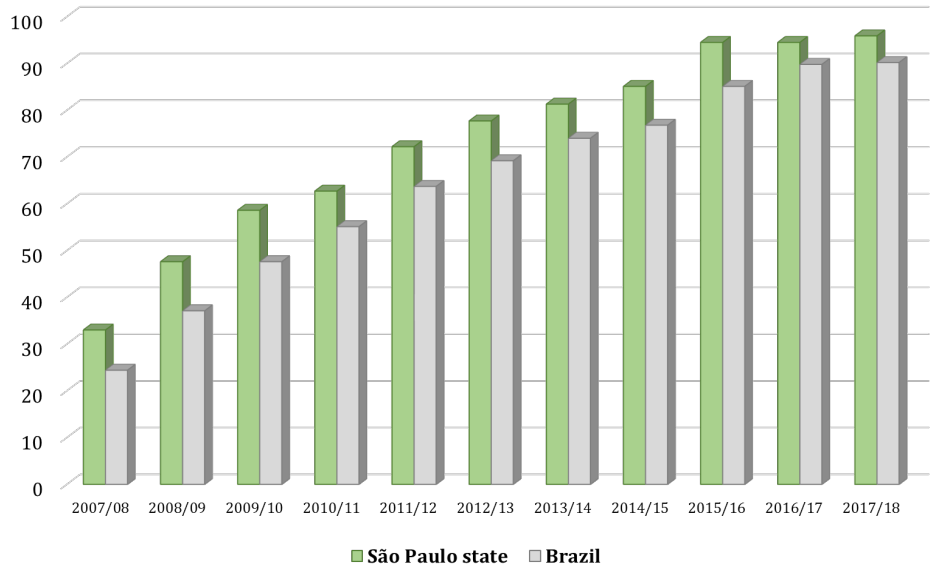
[6] UNICA's letter to CARB of April 23, 2018: https://bit.ly/2KJFEKO

[7] UNICA's letter to CARB of July 5, 2018: https://bit.ly/2MvNyt2

mechanization level in 2017/2018 crop year, compared to 28.5% one decade ago[8]. Indeed, this index is even higher according the Sugarcane Technology Center (CTC), which estimated that mechanical harvesting in areas owned by mills in South-Central region reached 98% in the named season. For the current 2018/2019 harvest CONAB estimates 97% mechanization in the South-Central region.[9] This increased mechanization has coincided with a period of increased production. According to the same CONAB report, the increase of sugarcane harvest in Brazil since the 2007/2008 harvest was of 359.6%, meaning some 4,391 more harvests in the field.[10]

As CARB is aware, São Paulo state government, in partnership with UNICA and sugarcane growers association (ORPLANA), created in 2007 a Green Ethanol Protocol, a pioneer initiative that, among other commitments, eliminated pre-harvest field burning in 2017. According to the Environmental Secretary, 95% of all sugarcane processed in the São Paulo state is under the management of certified parties.[11] Since June 2017 this commitment has entered into a new phase, now called More Green Ethanol Protocol, that continues to reiterate the pre-harvest field burning commitment, but includes the important commitment of restoring riparian vegetation around cane fields.

Sugarcane Harvesting– Fast Mechanization Process in Brazil



[8] http://www.conab.gov.br/OlalaCMS/uploads/arquivos/17_08_24_08_59_54_boletim_cana_portugues_-_2o_lev_-_17-18.pdf (page 60)

[9] Boletim Cana 2 Levantamento 18/19 (page 55): https://bit.ly/2wiZrYb

[10] Boletim Cana 2 Levantamento 18/19 (page 56): https://bit.ly/2wiZrYb

[11] Slide 3 of the document: http://arquivos.ambiente.sp.gov.br/etanolverde/2017/06/etanol-verde-relatorio-preliminar-safra-16_17-site.pdf

Source: CONAB (National Supply Company, from the Brazilian Ministry of Agriculture, Livestock and Food Supply

As previously mentioned, our industry has invested a great deal in mechanization in the sector in the last decade. These investments 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), considering the parameters given in Table 1. We believe there is strong evidence that the soil carbon stocks increase due to unburned mechanized harvesting[12]. Estimations from Figueiredo and La Scala Jr (2011)[13] indicate that the emissions in the mechanized harvesting are almost 1500 kg CO_2eq ha^{-1} $year^{-1}$ lower than those for the burned harvesting, since it leads to a soil carbon sequestration of more than 1170 kg CO_2eq ha^{-1} $year^{-1}$.

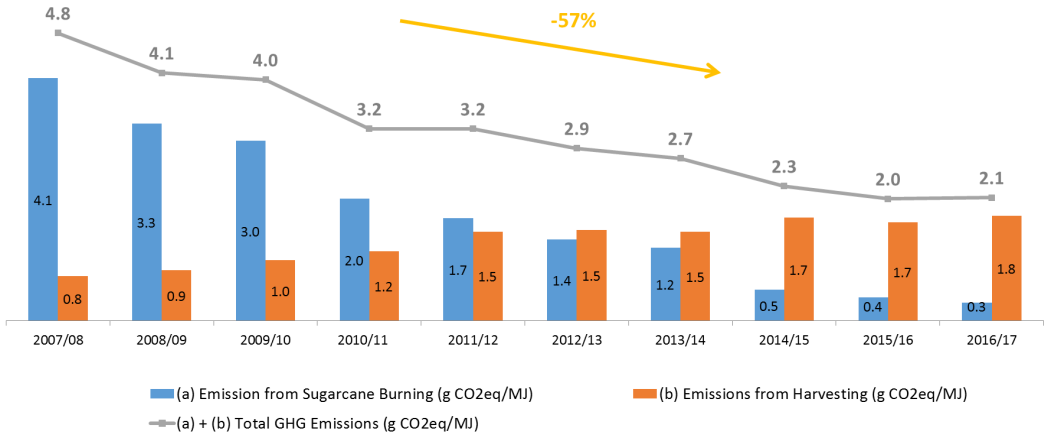
Table 1: Parameters used for the estimation of emissions balance between burned and mechanized harvesting

Parameter	**Value/source**
% Mechanized harvesting	CONAB
Sugarcane production	UNICA
Sugar and ethanol production	UNICA[11]
Straw burning emissions	2.7 kg CH_4/t dry matter burnt 0.07 kg N_2O/t dry matter burnt[12]
Straw to cane stalk ratio	140 kg (dry basis) per tonne of stalk
Harvester's diesel consumption	74 L/ha
Life cycle diesel emissions	83.8 g CO_2eq/MJ

[12] Cerri, C. C., Galdos, M. V., Maia, S. M. F., Bernoux, M., Feigl, B. J., Powlson, D. and Cerri, C. E. P. European Journal of Soil Science; Special Issue: Soil Organic Matters; Volume 62, Issue 1, pages 23–28, February 2011

[13] Figueiredo EB, La Scala Jr N. Greenhouse gas balance due to the conversion of sugarcane areas from burned to green harvest in Brazil. Agriculture, Ecosystems and Environment 141 (2011): 77-85.

Emissions Balance (Burning vs. Mechanization)



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

A good example of how a low default mechanization value hurts Brazilian sugarcane ethanol's CI is the recent increase of the emissions related to straw burning from 10.06 to 12.04. In practical terms this means that each 10% of mechanized harvest is worth 1.2 CI points. By forcing mills to use a default mechanization value of 80%, CARB is denying 2.4 points of CI for mills who have 100% mechanized harvest.

UNICA continues to urge that CARB include an option for self-declared mechanization percentage in the tier 1 CI calculator. If Staff feels that variable input for this factor is not feasible, we urge that the Board not approve this version of the calculator until staff adjust the default mechanization values for Center-South Brazil to a value no lower than 85% and to Sao Paulo State to a value no lower than 95%. By doing so, staff will be scoring this input more closely to actual practice and will most likely be spared from having to go thru multiple Tier 2 applications requests from the hundreds of Brazilian mills registered with CARB.

UNICA member mills, who represent the vast majority of Brazilian mills registered with CARB, are highly sophisticated enterprises who invest a great deal in the automatization of their agricultural and industrial processes. Third party verifying bodies in Brazil have, for years, audited mills' systems for certification schemes like the Bonsucro, EPA's RFS program and the LCFS itself. We encourage CARB staff to continue to reach out to verification companies in

Brazil, as well as to regulatory agencies in the country, in order to clarify doubts or misunderstanding regarding the automatized systems used by sugarcane mills.

We believe these updates are not only the best way to capture the reality of sugarcane mechanization practices in Brazil, but also the fairest approach to allow Brazilian ethanol to compete in the Californian market.

2 - Maritime Transportation

UNICA is very concerned that CARB staff continue to advocate for the inclusion of back-haul penalties for maritime transportation of sugarcane ethanol to California. We have not seen any data to support CARB's assertion that ocean tankers bringing ethanol fuel from Brazil to California will necessarily return empty to Brazil. From conversations with staff, we understood that this back-haul emission penalty is due to a conservative approach staff wants to take in case such empty return trips happen in the future. We decided to verify our observations that ethanol ships from Brazil do not return empty and shared our findings with staff in the Exhibit C of our April 23, 2018 letter.[14]

As the maps showed, in the past two years, nine ships have brought ethanol from Brazil to California, for a total of 10 trips (vessel High Valor has made the trip twice). From California, these vessels called other ports to deliver other products. The tracking of these vessels confirmed our observations that ships do not necessarily go back to Brazil, and certainly not empty. Out of 10 trips, only one was back to Brazil, with the vessel carrying diesel. All other nine trips were to Asia, Europe, and Mexico.

Contrary to what CARB staff had mentioned during our conversations, back-haul penalty is not minimal for sugarcane ethanol. Our mills ran a comparison of CA-GREET 2.0 and CA-GREET 3.0 (images below) models and found out that an average exporting mill would have its CI increased by 3.5 points due to this penalty.

[14] UNICA's Letter to CARB of April 23, 2018, pages 23-32: https://bit.ly/2KJFEKO

CA-GREET 2.0 (CI results in red):

Transportation and Distribution			7,78
From ethanol plant to port	HDD Truck		
Shares	100%		
Miles	244		
From ethanol plant to port	Pipeline		
Shares	100%		
Miles	0		
From ethanol plant to port	Rail		
Shares	100%		
Miles	0		
From port to CA port	Ocean Tanker		
Shares	100%		
Miles	8.953		
From CA port to blending terminals	HDD Truck		
Miles	40		
From terminals to fueling stations	HDD Truck		
Miles	50		

CA-GREET 3.0 (CI results in red):

Ethanol Transport and Distribution			11,36
From Ethanol Plant to Brazil Port	Mode: HDD Truck	68642343,2850547 dry gals	
Miles	244		
From Brazil Port to California Port	Mode: Ocean Tanker	100%	
Miles	8.953		
From California Port to Blending Terminal	Mode: HDD Truck	100%	
Miles	40		
California Blending Terminal to Refueling Station	Mode: HDD Truck	100%	
Miles	50		

Maritime transportation would certainly not be efficient and affordable if vessels travelled empty around the world. Assuming that the energy consumption and associated emissions of the ocean tanker's round trip be attributed to sugarcane ethanol is speculative and arbitrary, and causes a tremendous impact in sugarcane ethanol competitiveness in the California market. **We urge staff <u>not</u> to impose back-haul penalties on Brazilian sugarcane ethanol, since these penalties are not supported by current market and trading practices. Additionally, UNICA would like to request that staff make available the evidence CARB has obtained to justify the imposition of such penalty on sugarcane ethanol.**

3– Straw Emissions and Credits

From previous conversation with CARB staff, we understand that the agency intends to discount electricity credits generated from straw (or sugarcane residues – leftover fibers, stalks and leaves) for all sugarcane ethanol pathways. Our understanding is that the technical basis

for such a move is the belief that straw removal from the field may influence the need for supplementary use of nitrogenous fertilizers (N-Fert).

We agree that this is an important issue for carbon footprint calculation considering the outsized role N-Fert has in overall GHG emissions from biofuels. Given the importance of this issue for the LCFS program and for Brazilian sugarcane ethanol producers, we encourage CARB to perform a detailed analysis that better reflects the practice in Brazil, accounting for straw emissions and credits in a more complete manner prior to making these amendments. In the following paragraphs, we provide a summary of the most relevant literature on the subject.

Vitti et al.[15] (2007) concluded that Nitrogen (N) and Sulfur (S) stocks of root system are positively correlated with sugarcane yield in the next crop. Figueiredo (2011)[16] indicates that in green-harvested areas, 1619.8 $kgCO2e.ha^{-1}$ are emitted into the atmosphere each year, mainly due to fertilization and diesel use. However, it is worth noting that the results heavily depend on the site-specific characteristics. Fortes et al. (2012)[17] points out those sugarcane post-harvest residues is an important source of carbon and nutrients to soil-plant system. In a recent literature review, Carvalho et al. (2017)[18] argue that the indiscriminate removal of crop residues can reduce the environmental benefits of bioenergy. The same study indicates that benefits in soil carbon (C) stocks were reduced when total aboveground residue was removed while partial removal of sugarcane residues did not reduce soil C stocks.

However, it is recognized that nitrogen from plant residues goes through complex processes, involving several paths to N_2O, leaching to groundwater and surface water trapping, as well as direct emissions of the soil as N_2O, leaving a small fraction for effective use in the cultivation of the plant. Evidences from Vitti et al. (2008)[19] and Vitti et al. (2011)[20] show that nitrogen from straw does not contribute to sugarcane nutrition and that N from straw is below 1%.

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[15]Vitti, A.C. et al., (2007). Produtividade da cana-de-açúcar relacionada ao nitrogênio residual da adubação e do sistema radicular. Pesquisa Agropecuária Brasileira. Brasília, v.42, n.2, p. 249-256.

[16]Figueiredo, E.B. (2011). *Greenhouse gas balance due to the conversion of sugarcane areas from burned to green harvest in Brazil. Agriculture, Ecosystems and Environment* 141. p. 77-85.

[17]Fortes, C. et al. (2012). *Long-term decomposition of Sugarcane harvest residues in São Paulo state, Brazil. Biomass and Bioenergy* 42. p. 189-198.

[18]Carvalho, J.L.N. et al. (2017). *Contribution of above and belowground bioenergy crop residues to soil carbon. Global Change Biology – Bioenergy.*

[19] Vitti, A.C. et al., (2008). Mineralização da palhada e crescimento de raízes de cana-de-açúcar relacionados com a adubação nitrogenada de plantio. Revista Brasileira de Ciência do Solo. 32:2757-2762, Número Especial.

[20]Vitti, A.C. et al., (2011). Nitrogênio proveniente da adubação nitrogenada e de resíduos culturais na nutrição da cana-planta. Pesquisa Agropecuária Brasileira. V. 46, n. 3, p.287-293. Brasília – São Paulo, Brasil.

Recent literature corroborates that **there are levels for soil straw removal, with little or no impact on the need for nutrient replacement.** Neto (2015)[21] points out that the presence of different amounts of sugarcane straw did not change N_2O emissions relative to bare soil (control). In an extensive literature review, Carvalho et al. (2016)[22] verifies that crop residues remaining on sugarcane fields provide numerous ecosystem services including nutrient recycling, soil biodiversity, water storage, carbon accumulation, control of soil erosion, and weed infestation. Such agronomic and environmental benefits are achieved when 7 Mg ha^{-1} of straw (dry mater) is maintained on soil surface (about 50% of straw).

We should note that leaving about 40%-50% of sugarcane residues on the field leads to a mean annual C accumulation rate of 1.5 Mg ha^{-1} $year^{-1}$ for the surface to 30-cm depth (0.73 and 2.04 Mg ha^{-1} $year^{-1}$ for sandy and clay soils, respectively). It is caused by the conversion from a burnt to an unburnt sugarcane harvesting system, which is the case of the great majority of sugarcane fields in Brazil (Cerri et al, 2011)[23]. Ending the practice of burning cane fields also provides additional safety benefits, which are not being captured in the mechanized credits in LCFS.

Considering the above, we suggest that **up to 50% of the straw could be safely removed from sugarcane fields to produce bioelectricity without affecting GHG emissions in agricultural activities and complementing the facility's energy exports eligible for emissions credits**. We, therefore, recommend that the new calculator should have a place to input information on collected straw and its respective cogenerated electricity. This is an extremely important issue for Brazilian producers and we will be glad to collaborate with CARB to ensure that all nuances of sugarcane ethanol production are captured in the calculator.

In the latest published documents, we have noticed that staff recommended changing the N content of straw, from 0.37% to 0.53%. However, there is no clear justification for this approach apart from the "averaging" of results from four studies. UNICA does not support averaging of results, as it has no scientific basis. We would like to request that CARB staff be more specific and provide detailed information regarding the changes in this parameter so we can run accurate comparisons among the CA-GREET models. We have consulted experts who believe that actual values are closer to the lower range. We would be glad to provide further background and scientific information if we are allowed additional time.

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[21] Neto, M.S. et al., (2015). *Direct N_2O emission factors for synthetic N-fertilizer and organic residues applied on sugarcane for bioethanol production in Central-Southern Brazil. Global Change Biology – Bioenergy.* Piracicaba, São Paulo – *Brazil.*

[22] Carvalho, J.L.N. et al. (2016). *Agronomic and environmental implications of sugarcane straw removal: a major review. Global Change Biology – Bioenergy.* Campinas – São Paulo, *Brazil.*

[23] Cerri, C. C., Galdos, M. V., Maia, S. M. F., Bernoux, M., Feigl, B. J., Powlson, D. and Cerri, C. E. P. European Journal of Soil Science; Special Issue: Soil Organic Matters; Volume 62, Issue 1, pages 23–28, February 2011

4 - Yeast usage

ARB staff also included the use of yeast in sugarcane ethanol production, resulting in an additional 3.34 g CO2e/gallon of ethanol. In sugarcane ethanol production, yeast is supplied in the beginning of the production cycle, then recovered and reused in the fermentation process throughout the year[24]. At the end of the processing year, this recycling strategy tends to reduce yeast usage to virtually zero. The document provided by ARB staff fails to provide the scientific reason to change the (correct) assumption of GREET 2.0. Accordingly, UNICA respectfully requests that CARB retain the assumption reflected in GREET 2.0.

5- Economic impact

The methodological decisions commented above have clear economic and commercial impacts. UNICA used the CA-GREET 3.0 model to simulate such impacts into sugarcane ethanol CI values. For such, we have considered how these decisions impact the CI of a theoretical mill outside Sao Paulo state, in center-south of Brazil that has about 95% of sugarcane mechanically harvested and exporting electricity to the grid.

As mentioned above, proposed regulation does not allow to input site-specific mechanized harvesting data in Tier 1, so it would have to use the default value of 65%[25]. In that case and considering all other parameter of CA-GREET 3.0, the ethanol CI would be about 4g CO2e/MJ higher than the actual value. Considering other changes not listed in this letter (yeast usage, and back-hall emissions in oceanic transport), observed CI would be at least[26] 8g higher than correct one.

Considering current average carbon prices in the 2018 LCFS program, such decisions results in an additional significant burden of about 24 cents per gallon. This additional burden, at the end of the day, results in unnecessary costs for Californian citizens, and distorts the market for low-carbon fuels by undervaluing Brazilian sugarcane ethanol relative to its climate benefits. Left unchanged, these decisions will ultimately dampen investment in our industry, potentially reducing the supply of low-carbon fuels to California.

UNICA understands and supports CARB's desire to enhance the LCFS. We want to make sure that the proposed amendments have their intended effect and allow more low-carbon sugarcane ethanol to reach Californian ports and gas tanks. To accomplish this goal, CARB needs to revisit the sugarcane calculator. We urge the Board to consider and implement our suggestions and ensure that sugarcane ethanol is fairly scored in the GREET-CA 3.0 modeling, so that Californian consumers can continue to reap the benefits of sugarcane ethanol. We are at

[24] Marina Oliveira de Souza Dias a,n , Rubens Maciel Filho b , Paulo Eduardo Mantelatto c , Otávio Cavalett c , Carlos Eduardo Vaz Rossell c , Antonio Bonomi c , Manoel Regis Lima Verde Leal **Sugarcane processing for ethanol and sugar in Brazil.** Environmental Development 15 (2015) 35–51.
[25] Please refer to documents from UNICA providing verification methods on such aspect.
[26] Sensitivity analysis for marginal electricity and other N2O emissions from straw burning was not performed due to lack of time.

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,

Elizabeth Farina

CEO

Leticia Phillips

Representative-North America