August 19, 2009

VIA ELECTRONIC MAIL

Mary D. Nichols
Chair, Air Resources Board
Headquarters Building
1001 I Street
Sacramento, CA 95814

Reference: *Proposed New CA-GREET Model Pathways for Brazil Sugarcane Ethanol*

Dear Ms. Nichols:

The Brazilian Sugarcane Industry Association (UNICA) welcomes the opportunity to provide specific comments on "Detailed California-Modified GREET Pathways for Brazilian Sugarcane Ethanol: Average Brazilian Ethanol, with Mechanized Harvesting and Electricity Co-product Credit (Version 2.2)," which the staff of the California Air Resources Board (CARB) published on 20 July 2009.

This letter expands on our previous correspondence[1] regarding lifecycle calculations of sugarcane ethanol and includes a number of specific recommendations concerning the calculations of indirect land use change in the Low Carbon Fuel Standard (LCFS). While UNICA is pleased that CARB has recognized several of our recommended changes on the "direct" lifecycle calculations, we are concerned about the delays in addressing the "indirect" land use change component of the calculations for the LCFS. We strongly urge CARB to act quickly in addressing the numerous concerns we — as well as a number of other stakeholders — have raised with regards to accuracy of CARB's calculations of the indirect effects of biofuels production. The alleged "indirect" land use change penalty, currently set at 46 gCO_2/MJ by CARB, is nearly four times greater than the "direct" lifecycle of sugarcane ethanol as calculated by the staff in the proposed new pathways.

Following a brief introduction of UNICA as having a direct and significant interest in these calculations, this letter focuses on cogeneration credits, straw yield and trash content of cane farming, cane transportation to the mill, energy consumption in agricultural lime production, and maritime transportation of ethanol.

[1] See our letter dated April 16, 2009, available online at http://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=lcfs09. We also note that UNICA representatives have met (in person and by phone) with CARB staff on various occasions, most recently on July 1, where we discussed many of these points addressed in this letter.

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I. INTRODUCTION

The Brazilian Sugarcane Industry Association (UNICA) is the leading trade association for the sugarcane industry in Brazil, representing nearly two-thirds of all sugarcane production and processing in the country. Our member companies are the top producers of sugar, ethanol, renewable electricity and other sugarcane co-products in Brazil's South-Central region, the heart of the sugarcane industry. Brazil is the world's largest sugarcane-producing country with over half a billion metric tons of cane harvested yearly.

In 2008, Brazil produced over 31 million tons of sugar and about 26 billion liters (6.8 billion gallons) of ethanol. In addition, the mills generate their own power from the sugarcane biomass. Official government data indicates that sugarcane mills produced approximately 16,000 GWh of electricity (corresponds to about 3% of the country's annual electricity demand) last year.

Thanks to our innovative use of ethanol in transportation and biomass for cogeneration, sugarcane is now the number one source of renewable energy in Brazil, representing 16% of the country's total energy needs according to official government data. Our industry is expanding existing production of renewable plastics and, with the help of innovative companies in California[2] will soon be offering bio-based hydrocarbons that can replace carbon-intensive fossil fuels.

II. COGENERATION CREDITS

UNICA welcomes CARB's proposed sugarcane ethanol pathways that provide emissions credits for excess cogeneration electricity from sugarcane biomass in Brazil.

The sale of excess cogeneration electricity from sugarcane mills to the national grid is a relatively new phenomenon in Brazil, due mostly to previous regulatory restrictions of the sale of electricity. It was not until 2002 that sugarcane mills began to sell meaningful volumes of electricity. Despite the novelty of this activity, a large number of mills have already begun to supply local power distribution companies with incrementally significant volumes of electricity.

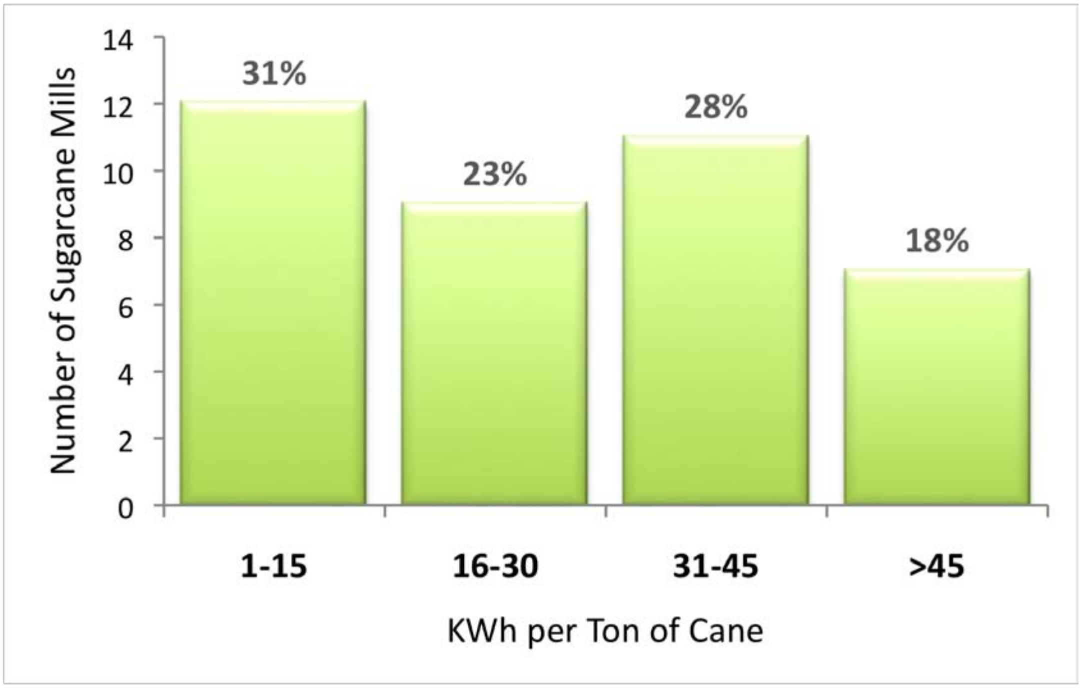
In order provide a full picture of how large the electricity surplus is today, UNICA surveyed every mill that is member of trade association and obtained data for electricity surplus exported to the grid in 2008. Of the 124 mills that are members of UNICA, 39 mills reported exporting a total of 3,062 GWh electricity surpluses to the grid in 2008.[3]

Based on the considerable sample (about two-third of all sugarcane produced in Brazil in 2008), the average cogeneration surplus for <u>all</u> sugarcane mills is Brazil was 10.5 kWh/t in 2008. And, if we only include the 39 mills that reported exporting to the grid, the average for the exporting

[2] For example, Emeryville-based Amyris announced last year a partnership with one of UNICA's member companies to produce fuels such as diesel and jet fuel for commercial uses. See http://www.amyris.com for more details. We are aware of similar efforts between a number of other California-based companies and sugarcane mills in Brazil.
[3] More detailed supporting information was provided to CARB on a "Confidential Business Information" basis on ___.

mills was approximately 25 kWh/t, which is nearly equal to the values proposed by GREET's creator, Michael Wang.[4] Furthermore, we note in the data that there about 20% of the mills already are producing 40 kWh/t and we the overwhelming evidence is that this trend will continue, if not increase.

Figure 1: Histogram of Sugarcane Cogeneration Electricity Exports in 2008 (excludes mills with no exports)



Source: UNICA Member Mills.

As we detailed in our earlier comments to CARB, sugarcane mills in Brazil will soon produce averages of 75kWh/t by using all bagasse in high-pressure steam systems. [5] However, since the trend towards mechanization (i.e., no cane burning) is well underway (50% in São Paulo state and about 35% in all of Brazil),[6] it is reasonable to expect that by 2020 average mills will have performance reaching 130 kWh/t given the mills will be bringing about 40% extra cane straw (i.e., trash) that was previously burnt in the field.

CARB's new proposed pathway for sugarcane ethanol includes a cogeneration credit of 7 gCO$_2$/MJ is accurate for 2008 but will require updates in coming years. Therefore, we recommend that that CARB plan for an update to the cogeneration credits to reflect the expected increase of cogeneration electricity surplus exported to the grid.

[4] See "Life-Cycle Energy Use and Greenhouse Gas Emission Implications of Brazilian Sugarcane Ethanol Simulated with the GREET Model," by Michael Wang et al. in International Sugar Journal (2008), available online at http://www.transportation.anl.gov/pdfs/AF/529.pdf.

[5] See pages 5-10 of our April 16 letter to CARB.

[6] These estimates are made by the Brazilian Space Agency (INPE) and are beyond any dispute today. The resulting percentages are from remote sensing analysis and made public on the Internet (see http://www.dsr.inpe.br/canasat/ but only in Portuguese). The INPE figures corroborate CTC's own statistical analysis know as the "CTC Mutual Controls (Pampa and Agro-Industrial), again only available in Portuguese.

III. STRAW YIELD

As UNICA's prior communications with CARB indicated, there is no scientific evidence to support the straw yield figures that CARB uses in the CA-GREET.

The figures are above the norm for Brazil's sugarcane industry. Instead of 0.19 dry ton straw per ton of cane, CARB should use 0.14 dry ton straw per ton of cane based on the work by Hassuani et al.[7] CARB should use either 280 kg trash (with 50% moisture) or 200 kg trash (with 30% moisture) in CA-GREET. We note that the author of the GREET model, Dr. Michael Wang, has specifically stated in an academic journal that GREET should be updated with 0.14 dry ton straw per ton of cane.[8]

Once again, we request that CARB should review the GREET model and supporting research and adjust the values for straw yield in CA-GREET for sugarcane ethanol. Moreover, we urge CARB to revise its original sugarcane pathways in order to correct this error given significant implications to the underlying calculations.

IV. CANE TRANSPORTATION TO MILL

As UNICA stated in its prior comments, CA-GREET grossly understates the efficiency of sugarcane transportation from cane fields to the mill.

Publicly available research and data detail the different specific fuel consumption and cargo payload capacity for trucks used to transport sugarcane from the field to the mills in Brazil.[9] Values on the right represent the averages in Brazil. The distribution between each type of truck is based on the work by *Macedo et al* from 2004, which showed that 8% of the trucks were 15t single wagon, 25% were 28t double wagon, and 67% were 45t triple wagon. Considering such distribution, the average payload used in Brazil for sugarcane transportation from the harvest field to the mill is 42 tons.

$$Single\ Truck = \frac{1}{2.2}\frac{l}{km}\ x\frac{1}{15\,t}\ x\,1000\frac{ml}{l} = 30.3\frac{ml}{t.km}$$

$$Double\ Wagon = \frac{1}{1.6}\frac{l}{km}\ x\frac{1}{28\,t}\ x\,1000\frac{ml}{l} = 22.3\frac{ml}{t.km}$$

$$Triple\ Wagon = \frac{1}{1.2}\frac{l}{km}\ x\frac{1}{45\,t}\ x\,1000\frac{ml}{l} = 18.5\frac{ml}{t.km}$$

$$\bar{X}_{Weighed} = 20.4\ \frac{ml}{t.km}$$

$$Four Wagon/58\,t = \frac{1}{1.1}\ \frac{l}{km}\ \ x\ \frac{1}{58\ t}\ \ x\ 1000\ \frac{ml}{l}\ = 15.7\frac{ml}{t.km}$$

[7] See *Biomass Power Generation: Sugar Cane Bagasse and Trash* edited by Suleiman Hassuani et al; published by United Nations Development Program (UNDP) and Sugarcane Technology Center (CTC) in Brazil, 2005. Available online at http://www.ctcanavieira.com.br/images/stories/Downloads/BRA96G31.PDF

[8] See "Life-Cycle Energy Use and Greenhouse Gas Emission Implications of Brazilian Sugarcane Ethanol Simulated with the GREET Model," by Michael Wang et al. in International Sugar Journal (2008), available online at http://www.transportation.anl.gov/pdfs/AF/529.pdf. Please note that the reference that Dr. Wang uses (Macedo et all) references a study that in turn is based on the previously cited original research by Dr. Suleiman Hassuani.

[9] For further detail, including formulas used, see page 23, Section A3, "Transport of Sugarcane from Field to Mill" [*author's translation*], by Isaias Macedo et al in 2004 São Paulo State Government report entitled "Net Greenhouse Gas Emissions in the production and use of ethanol in Brazil" [*author's translation*]. Portuguese version available online at http://www.unica.com.br/download.asp?mmdCode=76A95628-B539-4637-BEB3-C9C48FB29084

UNICA urges CARB to update its values for harvested cane transportation to the mill to reflect reality in Brazil, which clearly indicates that average trucks are 42, not 17, tons.

V. ENERGY CONSUMTPION IN AGRICULTURAL LIME PRODUCTION

UNICA has previously noted that CARB's data for Lime ($CaCO_3$) used in sugarcane fields in Brazil is not accurate.

In addition to what our April 16 letter[10] to CARB highlighted, we provide the following information in support of a revision of the California-Modified GREET data for Lime ($CaCO_3$). First, GREET assumes that energy consumption for lime mining is the same as Potassium Oxide (K_2O). But, the *CRC Handbook of Energy Utilization in Agriculture*, the main reference book for such data and ironically edited by a well-known ethanol critic, illustrates differences from just "grinding" Lime and the much more energy intense process in K_2O production.[11] Second, and more importantly, we have contacted the Brazilian Association of Lime Producers (EMBRACAL)[12] and obtained their analysis of energy consumption in the production of Lime in Brazil. As we had explained in our April 16 letter to CARB, the energy consumed in Lime ($CaCO_3$) is relatively low. According to EMBRACAL, based on a sample of seven representative companies, the total consumption of electricity is 7kWh/t of Lime and diesel fuel is 2.6 Liters/t of Lime.

We request that CARB adjust down the Lime ($CaCO_3$) values in its GREET analysis for Brazilian sugarcane.

VI. MARITIME TRANSPORTATION

We ask that CARB to provide data supporting its assertion that ocean tankers bringing ethanol fuel from Brazil to California will return to Brazil and apparently empty. We are aware of no evidence to support this.

We sought to verify our daily observations that ethanol ships from Brazil do not return empty and learned that these ships actually continue on to other destinations around the world. Based on our contacts with ethanol shipping companies, we have been informed that some bring other chemicals back to Brazil while many others return to Panama or Caribbean to pick up other products to send other parts of the world.

UNICA believes that it is highly speculative and arbitrary to assume that the energy consumption and associated emissions of the ocean tanker's round trip be attributed to sugarcane ethanol.

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[10] See pages 3 of UNICA's previously cited letter to CARB of April 16, 2009.
[11] See pages 25-26. Pimentel, David. 1980. *Handbook of energy utilization in agriculture*. Boca Raton, Fla: CRC Press. http://books.google.com/books?id=OGZRAAAAMAAJ.
[12] See http://www.embracal.com.br

VII. SUMMARY

Below we summarize the minimal input changes that we recommend to the California-Modified GREET analysis for Brazilian Sugarcane Ethanol, including the specific cells in the spreadsheet that should be modified or adjusted at this time.

Subject	Sheet	Cell	Value & Comment
Electricity credit	Inputs	E307	With electricity export
	Inputs	D307	-0.96 kWh/Gal (GREET default value)
Trash burning	Inputs	C224	50% moisture
CaCO3 production	Ag_Inputs	AA23	0.0 mmBTU/ton
	Ag_Inputs	AA24	0.022 mmBTU/ton[13]
	Ag_Inputs	AA26	0.080 mmBTU/ton[14]
Cane transportation	T&D	AE7	42 tons
Ethanol transportation	T&D	GU109*	Less than 0.0001 BTU/ton-mile (back-haul)

Notes: (*) CA-GREET does not appear to have a specific cell for the back-haul transportation.

I hope this letter will contribute to improving the development of the LCFS in California and remain at your disposal to answer any questions you or your colleagues may have.

Sincerely,

Joel W. Velasco
Chief Representative – North America

[13] 7 kWh/tonne * 3600 kJ/kWh * 1/1.055 BTU/kJ * 10^-6 mmBTU/BTU * 0.907 tonne/ton = 0.022 mmBTU/ton
[14] 2.6 L/tonne * 1/3.7854 gal/L *128450 BTU/gal * 10^-6 mmBTU/BTU * 0.907 tonne/ton = 0.080 mmBTU/ton