BRAZILIAN SUGARCANE INDUSTRY ASSOCIATION
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February 10, 2009

VIA ELECTRONIC MAIL

Mr. John Courtis
Manager, Alternative Fuels Section
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Dear John:

I am writing to provide specific comments to the draft document "Detailed California-Modified GREET Pathway for Brazilian Sugarcane Ethanol," (GREET-CA) which was posted on the website of the California Air Resources Board on January 12 of this year. In the spirit of transparency and in order to elicit a better dialogue with other stakeholders, we request that this letter be made available to the public.

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 Brazil. Our 116 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. During the 2008/09 harvest, the region produced about 6.5 billion gallons of ethanol and over 26.5 million tons of sugar. In addition to generating its own power from the sugarcane biomass, sugarcane mills provided approximately 1,800 average megawatts of electricity to the national grid (corresponds to about 3% of the country's annual electricity demand). 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. And our industry is expanding existing production of renewable plastics and, with the help of innovative companies in California, soon offering bio-based hydrocarbons that can replace carbon-intensive fossil fuels.

Our initial assessment of the results of the GREET-CA calculations suggests that it was carefully done, capturing many of the complexities of our agricultural and industrial operations. This is not surprising given that GREET's researchers have worked with Brazilian lifecycle assessment scholars (namely Drs. Joaquim Seabra and Isaias Macedo) to incorporate and harmonize some of the unique characteristics of sugarcane production systems and processing in the original GREET model. However, industry practices continue to evolve, and we believe it is critical that the model reflect the current state of the Brazilian sugarcane industry and avoid penalizing those players who have made investments in more efficient and sustainable methods of production.

Given the tight timeline for CARB implementation as well as the complexity and uncertainty associated with such modeling exercises,[1] we reiterate the need for timely access to the model data assumptions, methodology, and other key factors underlying the model. Currently, we have had access to only the top line results from the Global Trade Analysis Project (GTAP) from Purdue University. Our experience with other similar models (e.g., Food and Agricultural Policy Research Institute (FAPRI) model) suggests careful analysis of land use dynamics in Brazil is fundamental to minimize inaccuracies in model outputs.[2]

We have focused our comments on the data and model concepts that have a material impact on the value of model outputs. Lifecycle analysis, by definition, involves a considerable number of variables with complex relationships. It has been the recommendation of various stakeholder fora (e.g. Global Bioenergy Partnership, Roundtable on Sustainable Biofuels, etc.) to simplify the analyses by eliminating some aspects that are clearly of smaller impact on the model's output.[3] For example, most Brazilian and international experts do not consider the volatile organic compounds and other pollutants in the greenhouse gas (GHG) calculations, but do include the inputs of energy of equipments and construction. It appears to us that GREET-CA does the opposite. Reaching a consensus on these approaches would facilitate analyses and comparisons going forward. For simplicity, we have highlighted only the discrepancies that lead to fundamental shifts in model mechanisms of those that have a significant impact on the value of model outputs.

Our comments below first address changes that should be applied across *any* sugarcane ethanol pathway based on current practices today. Then we discuss ongoing industry practices improvements that further reduce sugarcane ethanol's carbon intensity and the outlook for further changes. Finally, we outline technical and policy recommendations to CARB's sugarcane fuel pathways.

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[1] A recent workshop organized by Environmental Defense Fund (EDF) and the Energy Biosciences Institute (EBI) with over 120 experts noted the complex uncertainties associated with modeling lifecycle greenhouse gases. The report's summary states, "The rapidly evolving science and policy of GHG reductions involves a dizzying array of sectors and technologies that need to be managed. Fuels lifecycle modeling is a dynamic and rapidly evolving field that is struggling to narrow the many uncertainties regarding the direct and indirect GHG impacts of a rapidly growing variety of biomass feedstocks, production methods, and conversion processes. Indeed, little is known about the GHG impact of a wide range of cropping systems for biomass that might be employed to produce low carbon fuels." See page three of report summary, "Measuring and Modeling the Lifecycle Greenhouse Gas Impacts of Transportation Fuels," EDF & EBI's University of California Berkeley (July 2008), available online at http://www.edf.org/fuels_modeling_workshop.

[2] In a recently published article, scholars using the FAPRI model showed that the expansion of crops and pastureland takes place absent any sugarcane expansion in Brazil. Even recognizing that sugarcane expansion contributes to some displacement of other crops and pasture, there is no evidence that deforestation caused by indirect land use effect is a consequence of sugarcane expansion. See "Prospects of the Sugarcane Expansion in Brazil: Impacts on Direct and Indirect Land Use Changes" by André Nassar et al. in *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment* edited by Peter Zuurbier and Jos van de Vooren (2008), available online at
http://www.wageningenacademic.com/Default.asp?pageid=58&docid=16&artdetail=sugarcane

[3] See *Sustainable biofuels: Prospects and Challenges*, The Royal Society, January 2008, Policy Document 01/08. Available at http://royalsociety.org/document.asp?id=7366

II. Basic Changes for Any Brazilian Sugarcane Pathway

The following three changes based on current industry practices are requested for any Brazilian sugarcane pathway that CARB considers in the Low Carbon Fuel Standard (LCFS).

A. Sugarcane Farming. The straw yield figures are above the norm for Brazil's sugarcane industry. Instead of 0.19 dry ton straw per ton of cane, you should use 0.14 dry ton straw per ton of cane.[4]

B. Chemical Inputs. The energy values, and associated emissions, in the production of lime ($CaCO_3$) are said to be 0.6 g CO_2/MJ. However, lime produced in Brazil has significantly lower carbon intensity.[5] As correctly noted in CARB draft document, Brazil's base load electricity (average mix) is currently approximately 83% hydroelectric, though the marginal expansion mix has been mostly natural gas.[6] With this in mind, accurate input values for the production of lime in Brazil are 7 kWh electricity (with grid average mix) per ton of lime (not the mix of products found in some production plants outside Brazil, including calcium oxide) and 2.6 liters of diesel per ton of lime. The GREET-CA values should be 0.11 g CO_2/MJ in the production.

C. Sugarcane Transportation. It appears that the energy required for transportation, and consequently the associated emissions, are higher than obtained from our own ground-truthing measurements in Brazil. We believe that the discrepancy may well have to do with the assumptions about load performance of the vehicles. GREET-CA considers only 17 ton trucks, while a majority of mills already operate with trucks with two or three times greater loads.[7] The specific energy consumption values for transportation from the field-to-mill vary according to the type of truck used and distance travelled. The mean distance travelled for field-to-mill is about 12 miles, as GREET-CA correctly assumes. Based on proportion of each type of truck used in field-to-mill transport from latest available data (i.e., 2004), we know that 8% of trucks were 15-ton single wagon, 25% were 28-ton double wagon, and 67% were 45-ton triple wagons. Therefore, based on this 2004 data, we can calculate that the energy consumption of sugarcane transport

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[4] 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

[5] See Hassuani op cit., pg 157. Also, see Macedo, Seabra & Silva in "Greenhouse gases emissions in the production and use of ethanol from sugarcane in Brazil" in *Biomass and Bioenergy* (2008).

[6] Even when considering additional hydroelectric power expansion, emissions calculations should include transmission impacts, direct and indirect land use changes. New hydroelectric power is only available in remote and environmentally sensitive areas of Brazil (e.g. Amazon river basin), which requires very long transmission lines (over 1,000 miles) through high-carbon, high-biodiversity forests. For a recent account of this, see "Doubt, Anger Over Brazil Dams; As Work Begins Along Amazon Tributary, Many Question Human, Environmental Costs" in *Washington Post* on October 14, 2008. Also, for general background on Brazil's electricity grid see U.S. Department of Energy's Country Analysis Brief, available at http://www.eia.doe.gov/emeu/cabs/Brazil/Full.html

[7] See CTC report entitled, "Annual Agricultural Reporting for Harvests 98/99, 99/00, 00/01, 01/02, 02/03" [*author's translation*] for detailed background on ground-truthing in transport practices. For a broader discussion of these and other evolving practices, see *Sugar Cane's Energies*, edited by Isaias Macedo (2005) as well as *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment* edited by Peter Zuurbier and Jos van de Vooren (2008).

from field to the mill is approximately 20.4 ml/t.km, or about two-thirds of the consumption of a single wagon truck (i.e., 30.3 ml/t.km). In short, our recommendation would be to use 19,122 BTU/mmBTU instead of 25,722 BTU/mmBTU in Table 3.02.[8]

III. Improved Low Carbon Industry Practices

In the last few years, there have been significant operational improvements in the Brazilian sugarcane industry.[9] There are at least three inter-related changes that significantly impact carbon intensity calculations, namely:

- Reduction of pre-harvest field burning
- Mechanization of harvest
- Increased cogeneration efficiency

The impact of these practices on carbon intensity calculations as well as increasing adoption rates are discussed below.

GREET-CA presumes all sugarcane is burned in the field prior to manual harvest in Brazil.[10] Moreover, the model assumes all sugarcane biomass is used up in the ethanol production pathway, with no surplus/credit (either in the form of bagasse used as fuel or excess electricity produced in the cogeneration process). These are incorrect assumptions that do not reflect current industry practices. A growing share of Brazil's sugarcane harvest (approximately 35%) is not burned and is mechanically harvested.[11] We believe a generic, single sugarcane pathway cannot accurately incorporate these changes.

The mechanical harvesting (with no sugarcane field burning) yields a high amount of additional biomass (commonly referred to as "trash" and includes leaves and tops of cane stalks among other parts of the sugarcane plant). Some of this additional biomass is being recovered and transported to the mill for processing and much more is expected in the very near future.[12] This biomass recovery process increases electricity production through cogeneration (or, in the future, additional ethanol production once cellulosic pathways are commercially viable).

[8] For further detail, including formulas used, see page 23, Section A3, "Transport of Sugarcane from Field to Mill" [*author's translation*], of 2004 São Paulo State Government report entitled "Net Greenhouse Gas Emissions in the production and use of ethanol in Brazil" [*author's translation*]. Available online at http://www.unica.com.br/download.asp?mmdCode=76A95628-B539-4637-BEB3-C9C48FB29084
[9] See World Wildlife Fund's "Analysis of the Expansion of Sugarcane's Agro-industrial Complex in Brazil" [*author's translation*], available online at http://www.wwf.org.br/index.cfm?uNewsID=13760
[10] See "1.3 GHG Emissions from Straw Burning in Field" on page 22 of GREET-CA.
[11] Though the trend is for all sugarcane is to be mechanically harvested and not all burned cane, there are mills that still burn the sugarcane in the field but harvest it manually.
[12] See Hassuani op cit.

As changes in field operations continue, energy efficiency improvements at mills already are adding to the surplus electricity provided to the national grid.[13] In 2008, mills provided about 1,800 MWh, which corresponds to about 6.4 kWh per ton of raw sugarcane crushed.[14] This has happened because many of new mills have been retrofitted with high-pressure steam cycle generators that easily produce 70 kWh per ton of cane with bagasse alone.[15] These more efficient mills are entering into long-term supply contracts with power distribution companies.[16] For instance, for 2012, the amounts already contracted reach 7,600 MWh, which brings power generation to 12.5 kWh per ton of cane.[17] There will be additional electricity incorporate into the grid by 2012, either through the scheduled government auctions or via open market sales, but those contracts have not yet been signed. Finally, looking ahead, when the additional sugarcane biomass (i.e., "trash") is used for power production, the power generation values will increase to above 100 kWh per ton of cane within the decade (including bagasse and 40% of the straw previously burned in the field).[18]

IV. Trends in Industry Adoption

Mechanization and cogeneration are the common industry practices today that we expect to become rapidly adopted across all plants in the coming years.[19] These trends are being driven by the following policy and market realities:

- *Phase Out of Field Burning.* Under current regulations and agreements between the environmental authorities and the sugarcane industry, nearly all the sugarcane will be mechanically harvested by 2014 in the state of São Paulo. São Paulo accounts for 60% of all national production and almost 100% of sugarcane exports to the United States. São Paulo state law requires that sugarcane field burning be phased-out by 2021 from areas where mechanical harvesting is possible with existing technology (over 85% of existing sugarcane fields) and by 2031 in areas where this may not be possible (e.g., steep slopes, irregular topography, etc).[20] However, UNICA member companies have entered into an agreement[21]

[13] See page 10 in Angelo Gurgel, John M. Reilly, and Sergey Paltsev. "Potential Land Use Implications of a Global Biofuels Industry" *Journal of Agricultural & Food Industrial Organization* 5.2 (2007). Available at: http://works.bepress.com/angelo_gurgel/1

[14] Data for current sales is provided by the Brazilian government's Ministry of Mines & Energy and National Electricity Agency, the autonomous regulator, and compiled by the São Paulo Cogeneration Association (COGEN-SP). While all the data is in Portuguese, it is easily accessible online at http://www.aneel.gov.br and http://www.cogensp.com.br.

[15] See "Mitigation of GHG emissions using sugarcane bioethanol" by Isaias C. Macedo and Joaquim E.A. Seabra in *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment* edited by Peter Zuurbier and Jos van de Vooren (2008).

[16] See "Brazil to invest $21.2 billion in cogeneration" in *The Economist Intelligence Unit* (1 December 2008).

[17] See COGEN-SP for additional data and information, http://www.cogensp.com.br/cogensp/workshop/2008/Bioeletricidade_ENASE_01102008.pdf.

[18] For further details, please review Technical-Economic Evaluation for the Full Use Sugarcane Biomass in Brazil, (in portuguese), Joaquim Seabra, Universidade Estadual de Campinas, July 2008.

[19] See Hassuani op cit. Also see Rabobank's report "Power Struggle: The Future Contribution of the Cane Sector to Brazil's Electricity Supply" by Andy Duff and Rodolf Hirsch (November 2007).

[20] See São Paulo State Law 11.241 enacted on 19 September of 2002, which requires the elimination of sugarcane field burning, is available at http://sigam.ambiente.sp.gov.br/Sigam2/Repositorio/24/Documentos/Lei%20Estadual_11241_2002.pdf

[21] See "Protocolo Agro-Ambiental do Setor Sucroalccoleiro Paulista," available in Portuguese at http://www.ambiente.sp.gov.br/cana/protocolo.pdf

with the São Paulo Environmental Protection Agency to bring forward the deadlines for sugarcane pre-harvest burning to 2014 and 2017, respectively. The agreement also defines other important actions such as conservation programs and restoration projects for riparian corridors as set-aside land policies.[22]

- *Increasing Restrictions on Burning*. Existing plantations that still use manual harvesting in the state of São Paulo must obtain state-issued government permits for the pre-harvest sugarcane field burning. Environmental authorities have set strict contingencies upon which these permits can be suddenly revoked (e.g., if air humidity drops below 30%, cane burning restrictions are applied and if air humidity drops below 20%, all cane burning is suspended).[23] This uncertainty has pushed many producers to mechanical harvesting to eliminate associated operational risk.

- *Expansion only with Mechanization.* Since 1986 all new sugarcane plantations and mills are required to submit environmental impact studies prior to construction and operation in order to obtain required permits.[24] More recently, in order to receive a permit to establish green-field sugarcane mills, the São Paulo state environmental authorities require 100% mechanical harvesting. Other states are in active discussions to follow their lead. Moreover, additional regulations imposed by the state government of São Paulo establishes environmental zoning for the sugarcane industry and progressively stricter requirements for licensing and renewal of existing plantations and mills.[25] Not to be outdone, the federal government has announced that a similar requirement for mechanization will be established nationwide later this year.[26]

- *One-Third Harvest Mechanization Today.* The uncertainties caused by the impact of harvest permits, coupled with the aforementioned legislative and regulatory changes, have led to a quicker-than-expected transition to all mechanized, un-burned sugarcane harvest. According to Brazil's Sugarcane Research Center,[27] which works with nearly all sugarcane producers, about 35% of all sugarcane in Brazil is already mechanically harvested, and nearly all of this is not burned in the field. In 2008, about half of the sugarcane fields in the state of Sao Paulo were mechanically harvested and other states (e.g. Goiás, Mato Grosso do Sul, Paraná, etc.) are also implementing mechanical harvest. In fact, the robust pace of

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[22] See "Environmental Sustainability of Sugarcane Ethanol in Brazil" by Weber Amaral et al. in *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment* edited by Peter Zuurbier and Jos van de Vooren (2008). For
[23] See São Paulo State Environmental Agency's Resolution SMA 38/08 of May 16, 2008, available online at http://sigam.ambiente.sp.gov.br/sigam2/default.aspx?idPagina=123.
[24] See CONAMA (Brazilian National Council on Environment) first resolution in January 1986, available at http://www.antt.gov.br/legislacao/Regulacao/suerg/Res001-86.pdf. For more info on CONAMA's action regarding sugarcane, see http://www.mma.gov.br/port/conama/index.cfm
[25] See São Paulo State Environmental Agency's resolution SMA-088 of 19 December 2008 as well as resolution SMA-SAA 004, of [18] September 2008, available at http://www.ambiente.sp.gov.br/contAmbientalLegislacaoAmbiental.php#2009 and http://sigam.ambiente.sp.gov.br/sigam2/default.aspx?idPagina=123
[26] See statements by Environment Minister Carlos Minc on this as well as the environmental and economic zoning being prepared by a inter-ministerial group of the Brazilian government and expected to be publicly announced shortly. Available online at http://www.mma.gov.br
[27] See Centro de Tecnologia Canavieira (CTC), accessible online at http://www.ctcanavieira.com.br.

mechanization was recently highlighted in a John Deere earnings release that states, "sales are being helped by […] rising demand for sugarcane harvesting equipment."[28]

Any realistic evaluation of carbon emissions from sugarcane farming in Brazil should reflect the strict policies being implemented and action already taken that phase-out of sugarcane burning, increase in mechanical harvest and cogeneration output. Without reasonable allocation of these various aspects, GREET-CA cannot provide realistic carbon intensity values. In fact, the developers of the GREET model recognized this when they wrote, "elimination of open-field burning in sugarcane plantations will result in additional GHG emission reductions by sugarcane ethanol."[29]

V. Technical Recommendations

The table below summarizes the technical implications of actual industry performance improvements. Further below we provide a detailed explanation of how each fuel pathway component will be affected in GREET-CA by these changes. All the proposed changes are based on current production processes not projection of optimistic best-case scenarios. And, Recognizing the evolving nature of the technological improvements, a broader structure for how to integrate these and future improvements into sugarcane lifecycle analysis fuel pathways is discussed in the policy recommendations section.

	CARB COMPONENTS FOR SUGARCANE ETHANOL	CARB DRAFT ($g\ CO_2/MJ$)	PROPOSED CHANGES TO EXISTING AND/OR ADDITIONAL PATHWAYS
A	Sugarcane Farming	9.9	(1) Straw Yield should be changed to 0.14 dry ton per tone cane; (2) Cane burning emissions are at most 2.9 g CO_2/MJ under current conditions and are decreasing rapidly; (3) New pathways should be created to credit mechanized and un-burned harvest benefits
B	Agricultural Chemicals	8.7	Energy values in production of lime ($CaCO_3$) should be changed to 0.11 g CO_2/MJ based on average grid mix
C	Sugarcane Transportation	2.0	Total energy in transport from field to plant should be reduced to 19,122 BTU/mmBTU given trucks carry loads larger than 17 tons
D	Ethanol Production	1.9	Emissions from ethanol production should be lowered 1.1 g CO_2/MJ since not all bagasse goes into ethanol production
E	Ethanol Distribution	4.1	No major changes recommended at this point
F	Cogeneration Credit	0	(1) Credits of at least 1.8 to 3.6 g CO_2/MJ, based on low end of emissions scenarios, should be included; (2) Trends and literature confirm that credits will increase to offset other component emissions; (3) New sugarcane ethanol pathways would allow for accurate credits to be given, particularly for incentivizing less carbon intense processes

[28] See Deere & Company's second and third quarter of 2008 earnings reports, available online at http://www.deere.com/en_US/ir/financialdata/2008/thirdqtr08.html
[29] 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

A. Sugarcane Farming. Depending on various pathways and assumptions CARB decides to pursue, the values for sugarcane farming will vary. Considering the current levels of mechanical harvest (i.e., 35% of all cane) and a revised straw yield figure (14% of the cane) and 90% of actual burning in the burned area, total emissions from burning cane today should drop from 8.2 g CO_2/MJ to approximately 2.9 g CO2/MJ. That should be the baseline for GREET-CA pathways. However, as noted elsewhere, we recommend that GREET-CA either consider an even lower figure to recognize that the sugarcane ethanol bound for California comes from areas that are already mechanized or develop separate pathways to capture this carbon benefit.

B. Agricultural Chemicals. The production of lime ($CaCO_3$) in Brazil is considerably less carbon intense than GREET-CA suggests. As you noted, recognizing grid average mix and other factors, GREET-CA values for Lime production should be 0.11 g CO_2/MJ.

C. Sugarcane Transportation. Energy required for crop transportation from field to mill is exaggerated in GREET-CA, likely because of higher load performance of the vehicles used in Brazil. GREET-CA should consider trucks with two or three times greater loads, leading to a revised value of 25,722 BTU/mmBTU field to energy consumption.

D. Ethanol Production. As detailed at length in Sections III and IV above, GREET-CA inaccurately assumes all bagasse to go into ethanol production processes, with no surplus.[30] With a corrected understanding of the use of bagasse, the total GHG emissions for the ethanol production should be reduced from 1.9 g CO2/MJ to 1.1 g CO2/MJ on average with lower figures possible in the very near future.

E. Transportation and Distribution. We see no significant discrepancy between GREET-CA and our own analysis with regards to transport and distribution.

F. *Missing* Cogeneration Credit. There are no credits for excess cogeneration electricity from sugarcane biomass. There is an inherent fallacy in any analysis of sugarcane that does not take into consideration the increasing surplus of cogeneration electricity produced at sugarcane mills in Brazil. Though GREET-CA recognizes that sugarcane bagasse is used to produce steam and electricity to power the processing, it does not consider that the mill is generating an increasing surplus of electricity, which is sold into the national grid displacing carbon intense sources of electricity. In other pathways (e.g., Farmed Tree Cellulosic), such credits are given and we see no reasonable basis to deny it

[30] To recap, mechanical harvest yields a significant increase in the amount of biomass (commonly referred to as straw or trash) that comes to the mill, instead of being burned in field. This additional biomass is now added to the existing bagasse (cane biomass remaining after juice extraction) to generate steam and electricity for the mills processes as well as sale of surplus electricity to the national grid. Finally, mills have been replacing older, low-pressure boilers with higher-pressure boilers, therefore obtaining greater efficiencies in power generation. All additional electricity generation is leading to a growing role of cogeneration.

within the GREET-CA for sugarcane.[31] Failure to incorporate the anticipated growth in electricity cogeneration not only undermines one of the greatest environmental benefits of the sugarcane pathway, but also creates further discrepancies in the years ahead that could discourage carbon mitigation behavior. Based on the low end of the range of anticipated electricity sales to the grid (i.e. 12.5 kWh/ton which is already contracted for 2012), a GHG emission reduction credit of 1.8 to 3.6 g CO_2/MJ should be granted under GREET-CA.[32] Looking ahead, sugarcane mills operating with 70 kWh/t will achieve emission credits in the 10-20 g CO_2/MJ range, likely completely offsetting any emissions during production, processing and transportation. In fact, as the Organization for Economic Cooperation and Development (OECD) recently pointed out in a lengthy comparative analysis of biofuels, sugarcane ethanol may soon have negative emissions on a lifecycle basis for sugarcane ethanol.[33]

VI. Policy Recommendations

CARB should consider either of the following adjustments to the GREET-CA fuel pathways for sugarcane in order to reflect the variations in agricultural and industrial operations in Brazil's sugarcane industry, as well as to accurately credit carbon-reducing behavior:

- Option One. GREET-CA could assume at least 70% of the sugarcane used for ethanol to be mechanically harvested and not burned in the field.[34] As explained in Section IV, the main sugarcane producing area of Brazil surpassed 50% mechanization in the last harvest and is required to have achieved at least 70% mechanization by 2010. Moreover, the higher figure (from 35% actual today to 70% proposed) more accurately represents the actual source of the sugarcane ethanol that makes it to the United States; or,

- Option Two. Alternative pathways could be developed for mechanically harvested and/or non-burned sugarcane ethanol. While more complex, such a method would have the benefit not only of accurately portraying current practices but also proactively encouraging lower carbon intensity sugarcane biofuels production, which is the underlying public policy goal of the LCFS. In separate pathways, credit would be given to mills for non-burning of sugarcane in the field (i.e., avoided emissions) as well as the cogeneration surplus power

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[31] Any denial to accept the surplus energy cogenerated would require at the *very least* a reallocation of the emissions to power the ethanol production, further reducing sugarcane's ethanol overall emission.

[32] The range depends on the baseline emissions scenarios for Brazilian electricity. It must be noted that under the recently approved European Commission Directive, cogenerated electricity from sugarcane was given similar carbon credits for ethanol. See http://ec.europa.eu/energy/strategies/2008/2008_01_climate_change_en.htm

33 "Ethanol from sugarcane is the pathway where the most consistent results were found. All studies agree on the fact that ethanol from sugar cane can allow greenhouse gas emission reduction of over 70% compared to conventional gasoline. The large majority of reviewed studies converge on an average improvement around 85%. Higher values (also beyond 100%) are possible due to credits for co-products (including electricity) in the sugar cane industry. This reflects the recent trend in Brazilian industry towards more integrated concepts combining the production of ethanol with other non-energy products and selling surplus electricity to the grid." In Economic Assessment of Biofuel Support Policies by Organization for Economic Co-operation and Development (2008), available online at http://www.oecd.org/document/30/0,3343,en_2649_33785_41211998_1_1_1_37401,00.html .

[34] Another way to implement "Option One" would be to set the percentage as a variable number since it can be easily obtained on a annual basis from public and official sources in Brazil.

displacing carbon intense fuels such as natural gas or heavy fuel oil used in marginal power generation in Brazil.

Regardless of the final approach on additional pathways, we strongly request that CARB adopt some verifiable mechanism that ensures best carbon mitigating practices are rewarded on a timely manner so as to ensure quicker adoption. Merely updating the GREET-CA model in hindsight will not be enough to reach the objectives of California's forward-looking climate change policy.

VII. Conclusions

We commend CARB for a thorough assessment of the lifecycle emissions associated with the production of sugarcane ethanol. We believe, however, your assessment requires a comprehensive update with more accurate and realistic data from current experience and anticipated trends in Brazil. Perhaps no other issue deserves greater attention than the credits resulting from the combination of reduced field burning, increased mechanization, and improved boiler efficiency, which were absent in CARB's analysis.

For further research, we would suggest CARB consider evaluating whether improvements in flex-fuel engines could yield greater engine efficiency and lower emissions in California. Flex fuel engines in the United States are very similar to ordinary gasoline engines, with almost the same compression ratios (commonly in the range of 9.0:1 to 10.5:1) and, consequently, not fully optimized to burn E85 ethanol blends. Since 2003, when flex fuel cars were introduced in Brazil, there has been a steady evolution in flex engines, which are now being manufactured in Brazil with higher compression ratios (12:0:1 to 13.5:1) to take advantage of the higher blends (from 20-25% up to 100% ethanol). Currently industry analysis suggests that such changes would result in 5-10% improved fuel efficiency and, consequently, in even lower carbon emissions with ethanol blends.[35] Simply put, improvements in flex-fuel engines uses in the United States could help California achieve LCFS's goals.

We look forward to discussing the issues described in this letter with you and other experts of the CARB team as well as reviewing any additional documents and analyses that are made available, particularly the land use changes modeling using the GTAP.

Sincerely,

Joel Velasco
Chief Representative - North America
Brazilian Sugarcane Industry Association

[35] See presentation by Volkswagen's Henry Joseph available http://www.royalsoc.ac.uk/downloaddoc.asp?id=4248