BRAZILIAN SUGARCANE INDUSTRY ASSOCIATION
ETHANOL • SUGAR • ELECTRICITY

April 8, 2013

VIA EMAIL
Air and Radiation Docket and Information Center
Environmental Protection Agency
Mailcode 2822T
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

Re: UNICA's Comments on "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards," Docket EPA-HQ-OAR-2012-0546

To Whom It May Concern:

The Brazilian Sugarcane Industry Association ("UNICA") appreciates the opportunity to provide these comments on the proposed rule, entitled "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards" ("2013 RFS2 Rule"), 78 Fed. Reg. 9281, issued by the United States Environmental Protection Agency ("EPA") on February 7, 2013.

UNICA is the largest organization representing sugar, ethanol, and bioelectricity producers in Brazil. UNICA's members are responsible for more than 50% of all ethanol production in Brazil and 60% of overall sugar production. UNICA's priorities include serving as a source for credible scientific data about the competitiveness and sustainability of sugarcane biofuels. The association works to encourage the continuous advancement of sustainability throughout the sugarcane industry and to promote ethanol as a clean, reliable alternative to fossil fuels. Sugarcane ethanol production uses 1.5% of Brazil's arable land and reduces greenhouse gas ("GHG") emissions by 90% on average, compared to conventional gasoline. And thanks to our innovative use of ethanol in transportation and biomass for power cogeneration, sugarcane is now a leading source of renewable energy in Brazil, representing about 15% of the country's total energy needs. The scope of the industry is expanding existing production of renewables and bioplastics and, with the help of innovative companies here in the United States and elsewhere, is beginning to offer bio-based hydrocarbons that can replace carbon-intensive fossil fuels.

UNICA supports EPA's proposal to maintain the statutory volume requirement for advanced biofuels and believes EPA should issue a final rule as soon as possible. Pursuant to the Energy Independence and Security Act of 2007 ("EISA"), EPA is required to complete a yearly rulemaking setting the volume requirement for cellulosic ethanol and, if necessary, modifying the volume requirements for advanced biofuels and renewable fuels, by November 30 of the preceding calendar year. 42 U.S.C. § 7545(o)(7)(D)(i). The purpose of the November 30 deadline is to ensure that renewable fuel producers have sufficient time to respond to EPA's final rule and adjust fuel production accordingly. By delaying the proposed 2013 RFS2 Rule until February 2013, EPA has limited the ability of Brazilian sugarcane ethanol producers to adjust production in response to EPA's final decision. At the time of this submission, the 2013/2014 season, which began on April 1, is already in progress. As a result, both sugarcane producers and ethanol mills have been forced to make production decisions for the 2013/2014 season based on the content of EPA's proposed rule. Specifically, mills must plan their output of ethanol (hydrous and anhydrous) as well as raw sugar based on expected demand. Any change to the proposed rule will create challenges for the Brazilian sugarcane ethanol industry as it seeks to assist EPA in achieving Congress' goals for renewable fuel consumption. By promptly issuing a final rule, EPA will give a measure of certainty to the industry for the remainder of the 2013/2014 harvest season. Further delays or changes from the proposed volumes would create disruption in the global biofuels marketplace and has the potential to cause considerable damages to producers and mills.

These comments, which build on UNICA's prior comments on the RFS2 program, are intended to provide updated information regarding Brazilian sugarcane ethanol production and export capacity and to respond to questions that EPA raised in the proposed rule. Specifically, these comments will:

1. Describe UNICA's past participation in EPA's RFS2 rulemaking;

2. Review recent scientific literature addressing the lifecycle GHG benefits of Brazilian sugarcane ethanol as compared to fossil fuels;

3. Provide updated harvest and export capacity estimates confirming that Brazilian sugarcane ethanol producers can meet EPA's projections for ethanol exports to the United States;

4. Explain why EPA cannot consider certain issues, including two-way trade in ethanol and the biodiesel tax credit, when deciding whether to waive a portion of the advanced biofuels volume requirement for 2013; and

5. Explain why it would be premature for EPA to make a decision with respect to the EISA's 2014 advanced biofuel volume requirement at this time.

Given UNICA's extensive experience with, and knowledge of, sugarcane ethanol production, and given our direct interest in the successful implementation of the RFS2 program, we request that EPA carefully and thoroughly consider these comments as it continues to analyze and review the impacts of the RFS2 program.

I. UNICA is an active partner in EPA's implementation of the RFS2 Program

Since Congress passed the EISA and directed EPA to implement the RFS2 program, UNICA has been actively involved on behalf of the Brazilian sugarcane biofuel industry. Brazil has decades of experience both in producing sugarcane ethanol and in utilizing ethanol in transportation fuels. This experience has allowed UNICA to assist EPA in developing and successfully implementing the RFS2 program, both through commenting on proposed rules and through other, less formal, means. As a result of Brazil's long-term commitment to sugarcane ethanol, Brazilian sugarcane ethanol producers have been able to supply the majority of undifferentiated advanced biofuels each year since the RFS2 program was implemented.

First, UNICA provided extensive comments on EPA's proposed RFS2 rulemaking in 2009.[1] In those comments, UNICA provided a detailed overview of sugarcane ethanol production in Brazil and its role as a renewable energy source. UNICA also provided extensive lifecycle analysis data to EPA demonstrating that Brazilian sugarcane ethanol qualifies as an advanced biofuel under the EISA. Finally, UNICA offered a series of detailed suggestions for how EPA could modify the proposed RFS2 rule to account for unique aspects of the Brazilian sugarcane and sugarcane ethanol industries. In response to UNICA's comments, EPA made adjustments to the lifecycle analysis for Brazilian sugarcane ethanol and appropriately concluded that GHG emissions reductions exceeded the GHG reduction threshold to qualify as an advanced biofuel.

Second, since EPA issued the RFS2 rule, UNICA has consistently supported EPA's annual rulemakings to modify the statutory volume requirements for cellulosic biofuels and consider potential adjustments to the volume requirements for advanced biofuels. In those comments, UNICA provided assurances, based on its role as the representative of the Brazilian sugarcane ethanol industry, that sufficient quantities of Brazilian sugarcane ethanol would be available to achieve the EISA's statutory volume requirements for advanced biofuels. UNICA also provided EPA with perspectives on how changes to the United States' laws and regulations, such as the expiration of the Volumetric Ethanol Excise Tax Credit, could affect Brazilian sugarcane ethanol exports to the United States.

Finally, UNICA has offered its expertise and experience with respect to other issues related to renewable fuels. For example, in response to petitions seeking to increase the allowable ethanol content in gasoline to 15 percent, UNICA provided detailed comments describing its expertise in ethanol blends and Brazil's extensive experience using ethanol blends that exceed 10 percent.[2] These comments were intended in part to demonstrate that it is technically and economically feasible for EPA to raise the allowable ethanol content in gasoline to achieve Congress' goals as expressed in the EISA. UNICA remains ready to assist EPA as it considers policy options that may be available to address the blend wall in the future.

Brazilian sugarcane producers have made a long-term commitment to providing clean, renewable sugarcane ethanol to meet energy and environmental goals in Brazil and United States, along with many other countries. As the largest trade association representing sugarcane ethanol producers in Brazil, UNICA is committed to partnering with government regulators such as EPA to promote sugarcane ethanol as a clean, renewable alternative to fossil fuels. In that capacity, UNICA remains committed to providing timely and credible data regarding the Brazilian sugarcane industry and its capacity to meet growing world-wide demand for renewable biofuels.

[1] UNICA, Submission of Comments: Regulation of Fuels and Fuel Additives: Changes to Renewable Fuels Standards Program, Docket EPA-HQ-OAR-2005-0161 (Sept. 25, 2009) ("RFS2 Comments").

[2] UNICA, Submission of Comments: Clean Air Act Waiver to Increase the Allowable Ethanol Content of Gasoline to 15 Percent, Docket EPA-HQ-OAR-2009-2011 (July 20, 2009) ("E15 Petition Comments"), attached as Exhibit A.

II. Sugarcane ethanol produces significant greenhouse gas benefits as compared to fossil fuels

One of Congress' primary purposes in passing the EISA was to reduce GHG emissions by utilizing advanced biofuels that offer superior GHG benefits on a lifecycle basis. Lifecycle analyses around the world have repeatedly shown that, when compared to the 2005 gasoline baseline, Brazilian sugarcane ethanol provides GHG benefits that are equal to or better than the emissions reduction threshold for cellulosic biofuels.[3] These lifecycle analyses formed the basis for EPA's approval of Brazilian sugarcane ethanol as an advanced biofuel in the final RFS2 Rule. 75 Fed. Reg. 14,670 (Mar. 26, 2010). More recent studies published after the RFS2 Rule continue to support EPA's conclusions regarding the GHG benefits of sugarcane ethanol.[4] As described below, a few recent studies that have questioned the GHG benefits of Brazilian sugarcane ethanol do not withstand scrutiny and provide no basis to doubt Brazilian sugarcane ethanol's status as an advanced biofuel.

In its comments on the proposed RFS2 Rule, which are hereby incorporated by reference, UNICA provided EPA with a detailed assessment of the lifecycle GHG emissions associated with Brazilian sugarcane ethanol.[5] The data provided by UNICA showed that Brazilian sugarcane ethanol reduces GHG emissions by up to 90% when compared to fossil fuels.[6] UNICA also provided an extensive critique of EPA's assessment of the lifecycle GHG emissions of Brazilian sugarcane ethanol, which included detailed information regarding Brazil's agricultural and energy sectors and how

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[3] *E.g.*, Wang. M. and M. Wu, "Life-cycle energy use and greenhouse gas emission implications of Brazilian sugarcane ethanol simulated with the GREET model." *International Sugar Journal* 110.1317 (2008): 527-45; Zuurbier, Peter and Jos Van de Vooren, eds. *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment*, (Wageningen, The Netherlands: Wageningen Academic, 2008); Macedo, I.C., Seabra, J., and J. Silva, "Greenhouse gases emissions in the production and use of ethanol from sugarcane in Brazil: The 2005/2006 averages and a prediction for 2020," *Biomass and Bioenergy*, 32.7 (2008): 585-95.

[4] Seabra, J.E.A., Macedo, I.C., Chum, H.L., Faroni, C.E. and C.A. Sarto, "Life cycle assessment of Brazilian sugarcane products: GHG emissions and energy use," *Biofuels, Bioproducts, and Biorefining*, 5 (2011): 519–532. Khatiwada, D., Seabra, J., Silveira, S., and W. Arnaldo, 2012. "Accounting greenhouse gas emissions in the lifecycle of Brazilian sugarcane bioethanol: Methodological references in European and American regulations," *Energy Policy*, 47(C) (2012):384-397. Seabra, J.E.A. and I.C. Macedo, "Comparative analysis for power generation and ethanol production from sugarcane residual biomass in Brazil," *Energy Policy*, 39(1) (2011): 421-428. Souza S.P. and J.E.A. Seabra, "Environmental benefits of the integrated production of ethanol and biodiesel," *Applied Energy* (2012), *available at* http://dx.doi.org/10.1016/j.apenergy.2012.09.016. Paes L.A.D. and F.R. Marin, "Carbon storage in sugarcane fields of Brazilian South-Central region," *Centro de Tecnologia Canavieira [Centre for Sugarcane Technology]. Technical Report*, (Piracicaba, São Paulo, 2011), *available at* http://www.unica.com.br/download.php?idSecao=17&id=16900437. Joaquim, A.C., Bertolani, F.C., Donzelli, J.L., and R.M. Boddey, "Organic Carbon Stocks in Soils Planted to Sugarcane in the Mid-South Region of Brazil: A Summary of CTC´s Data, 1990-2009," *Centro de Tecnologia Canavieira [Centre for Sugarcane Technology]. Technical Report*, (Piracicaba, São Paulo, 2011), *available at* http://www.unica.com.br/download.php?idSecao=17&id=18105453.

[5] UNICA RFS2 Comments at 2, 7-8.

[6] *Id.* at 7 (citing Zuurbier and Jos Van de Vooren (2008)).

they impact the lifecycle GHG benefits attributable to Brazilian sugarcane ethanol production.[7] Based on UNICA's comments, EPA adjusted its assessment of lifecycle GHG emissions for Brazilian sugarcane ethanol, concluding that such emissions were likely reduced by more than 60% as compared to the gasoline baseline. 75 Fed. Reg. at 14,790-91. As a result, Brazilian sugarcane ethanol qualifies as an advanced biofuel under the RFS2 program and total lifecycle GHG emissions reductions exceed the 60% threshold for cellulosic biofuels.

While UNICA continues to support EPA's conclusions in the RFS2 Rule, we are aware that EPA has recently been provided with studies published since 2010 that purportedly conflict with EPA's conclusions. While these studies do provide additional data about the Brazilian sugarcane ethanol industry, the results have unfortunately been misinterpreted or misapplied. To avoid any confusion, UNICA provides the following analyses to clarify the conclusions of these recent studies and explain why EPA's .

A. N_2O emissions associated with sugarcane production

Although EPA did not incorporate N_2O emissions from vinasse and filtercake in the RFS2 rulemaking, researchers have been including such emissions in lifecycle analyses for many years. Critics of sugarcane ethanol have suggested that this omission could call into question EPA's conclusion that sugarcane ethanol qualifies as an advanced biofuel. However, researchers have consistently found that application of vinasse and filtercake is a relatively small source of N_2O emissions. For example, Seabra *et al.* estimated emissions associated with vinasse and filtercake application were less than 2 gCO_2e/MJ ethanol using Tier 1 IPCC methodology.[8]

In addition, this limited impact of N_2O emissions does not incorporate the important reduction in emissions arising from environmental regulations in Brazil. In the last 20 years, the Brazilian government has limited the specific application of vinasse (m^3/ha) to eliminate the possibility of underground water contamination. In addition, the Brazilian government eliminated vinasse storage in unlined ponds and has required storage in impermeable tanks, lined channels, or, in some cases, pipelines. These changes are significantly reducing N_2O emissions associated with vinasse storage and transport. Additional experiments are currently being carried out in Brazil in order to verify whether the application of these vinasse and filtercake residues actually leads to N_2O emissions and which emission factor would be appropriate in this case. The experiments cover a wide range of conditions normally found in the sugarcane areas. UNICA believes that these experiments will improve our understanding of N_2O emissions associated with sugarcane production. Although it may ultimately prove conservative, UNICA believes that it is appropriate to continue to use the Tier 1 IPCC methodology and factors until an adequate amount of data is available to support an alternative approach.

B. Emissions associated with sugarcane burning

In December 2011, Tsao *et al.* released a study asserting that prior research based on satellite images underestimated the extent of sugarcane burning during

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[7] *Id.* at 9-10, 16-34.

[8] Seabra *et al*. (2011).

harvest.[9] The authors asserted that emissions associated with sugarcane burning had increased due to expansion in sugarcane growing areas. They found "regional estimates of burned area that are four times greater than some previous estimates." Critics of Brazilian sugarcane ethanol have used this study to suggest that the lifecycle GHG emissions reductions are not as large as previously thought. However, this study is of limited relevance for assessing current lifecycle GHG emissions because it is based on outdated data from 2001 to 2008. As a result, it does not reflect the changes that have taken place in response to the "Green Ethanol Protocol," a voluntary program to phase out sugarcane burning between 2014 and 2017.[10] By 2010, 155 sugarcane mills representing 90% of the production in Sao Paulo State had signed the protocol.[11]

Contrary to Tsao *et al.*'s conclusions, recent data show that sugarcane burning is declining steadily in Brazil. For example, a recent study by the Sao Paulo Environmental Secretary found that sugarcane burning represented 34.8% of total sugarcane area in the state,[12] well below the 50% value reported by Tsao *et al.*[13] A 2011 study by Aguiar *et al.* found, based on satellite imagery, that sugarcane burning had remained constant from 2006 to 2010, while mechanical harvest that does not require burning increased from 1.1 to 2.6 million hectares.[14] Likewise, according to the Sao Paulo Environmental Secretary, the burned area decreased from 2.13 to 1.67 million hectares, and the unburned area increased from 1.11 to 3.12 million hectares between 2006 and 2011.[15] These data confirm that sugarcane burning is being proportionally reduced and mechanized harvest is advancing in Brazil contrary to what Tsao *et al.* suggest.

Further, even if Tsao *et al.*'s conclusions were accepted it would not alter EPA's conclusion that sugarcane ethanol meets the minimum threshold for advanced biofuels under the RFS2 program. According to the authors' models and assumptions, total

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[9] Tsao, C-C., Campbell, J.E., Mena-Carrasco, M., Spak, S.N., Carmichael, G.R., & Chen. Y., "Increased estimates of air-pollution emissions from Brazilian sugar-cane ethanol," *Nature Climate Change: Advanced Online Publication* (Dec. 11, 2011), available at http://www.ucmerced.edu/sites/www/files/public/documents/brazil.pdf.

[10] UNICA, Green Protocol: 62.5 million ton reduction in CO2 emissions in Sao Paulo state (Nov. 26, 2009), http://english.unica.com.br/noticias/show.asp?nwsCode=%7B7F608E66-EF83-4106-A405-0940D34E8851%7D (last visited April 5, 2013).

[11] Aguiar, D., Rudorff, B.F.T., Silva, W.F., Adami, M., and M.P. Mello, "Remote Sensing Images Support of Environmental Protocol: Monitoring the Sugarcane Harvest in Sao Paulo State, Brazil," *Remote Sensing*, 12 (2011): 2682-3703, *available at* http://www.mdpi.com/2072-4292/3/12/2682.

[12] SMA Website (Sao Paulo State Environmental Secretary) http://www.ambiente.sp.gov.br/etanolverde/resultado-das-safras/ (last visited March 25, 2013). Unlike the Tsao *et al*. study, which relied exclusively on modeling, the SMA study was verified by empirical, *in loco* monitoring including satellite images, site visits, and questionnaires.

[13] Tsao *et al*., at 2.

[14] Aguiar *et al.* (2011).

[15] SMA Website (Sao Paulo State Environmental Secretary) http://www.ambiente.sp.gov.br/etanolverde/resultado-das-safras/ (last visited March 25, 2013). Unlike the Tsao *et al*. study, which relied exclusively on modeling, the SMA study was verified by empirical, *in loco* monitoring including satellite images, site visits, and questionnaires.

emissions grew by 60% while sugarcane production grew by 120%, suggesting that sugarcane production is becoming more efficient over time from a GHG emissions perspective. Further, while the authors did not publish a final lifecycle GHG emissions value, it is possible to infer a GHG reduction of approximately 70% as compared to the gasoline baseline.[16] Thus, the Tsao *et al*. study is consistent with EPA's findings and, in any event, superseded by more recent data regarding sugarcane burning in Brazil.

C. Emissions associated with land use change

In 2010, Lapola *et al.* published a study that projected direct and indirect land use change associated with sugarcane ethanol production in Brazil through 2030.[17] The authors concluded that expansion of sugarcane would likely displace pastureland. Similar results were obtained by Adami, *et al.*[18] Although they concur that direct land use change emissions are small, Lapola *et al.* proposed that indirect land use changes associated with conversion to pastureland may cause significant GHG emissions. While Lapola *et al*.'s combination of economic and spatially explicit modeling holds promise as a method for projecting GHG emissions associated with direct and indirect land use change, the exogenous assumptions underlying the authors' models call into question the ultimate results of the study. Specifically, if realistic assumptions regarding increases in cattle intensity and productivity are included, very little expansion of pastureland is required to compensate for conversion from pastureland to sugarcane production. Lapola *et al.*'s model incorporates a livestock density increase of 0.09 from 2003 to 2030. This is far below the observed increase in livestock density of 0.22 between 1996 and 2006. Assuming a similar increase in livestock density over the next two decades, virtually no indirect land use change would be required to compensate for sugarcane expansion. Similarly, Lapola *et al.*'s model underestimates increases in productivity for cattle ranching, which will also reduce the number of acres needed to meet demand for livestock products. Finally, the model's focus on total rather than marginal land use changes prevents the authors from establishing cause-effect relationships among the different demand drivers for land use change. In fact, the study produces similar results for pastureland expansion for a variety of different demand scenarios for biofuels, suggesting that the expansion of sugarcane may not be a causal driver of the expansion of pastureland. Given these questionable assumptions, the mere fact that sugarcane is expanding into pastureland in some areas does not necessarily mean that indirect land use emissions will increase.

UNICA continues to review all scientific analyses related to sugarcane, particularly its lifecycle emissions. We believe EPA's determination that sugarcane ethanol meets the emissions reduction threshold for advanced biofuels continues to be supported by the various analyses done by academic and other researchers around the world. We continue to make ourselves available for any further clarifying questions and

[16] Figure 1(b) provides a comparison of lifecycle CO_2e emissions for conventional gasoline and sugarcane ethanol.

[17] Lapola, D., Schaldach, R., Aclamo, J., Bondeau, A., Koch, J., Koelking, C., and J. Priess, "Indirect land-use changes can overcome carbon savings from biofuels in Brazil," *Proceedings of the National Academy of Science*, 107 (2010): 3388-3393.

[18] Adami, M., Freidrich, B., Rudorff, T., Freitas, R.M., Aguiar, D.A., Sugaware, L.M., and M.P. Mello, "Remote Sensing Time Series to Evaluate Direct Land Use Change of Recent Expanded Sugarcane Crop in Brazil*," Sustainability*, 4 (2012): 574-585.

appreciate the scrutiny applied by EPA in ensuring the scientific credibility of its determinations under RFS2 rulemakings.

III. EPA should maintain the EISA's statutory volume requirement of 2.75 billion gallons for advanced biofuels when it reduces the applicable volume for cellulosic biofuels

A central component of the EISA was Congress' commitment to promote cellulosic biofuels. Unfortunately, cellulosic biofuels have not developed at the pace expected by Congress, and producers will be unable to achieve Congress' goals for 2013. Thus, EPA has proposed to invoke its authority under 42 U.S.C. § 7545(o)(7)(D) to reduce the required volume of cellulosic biofuels down to the volume that it projects will be available in 2013. Under the same provision, EPA has discretion to reduce the statutory volumes of advanced biofuel and renewable fuel to account for the reduced contribution from cellulosic biofuels. We agree with EPA that such a reduction is not warranted here. First, in the EISA, Congress expressed clear intent to promote the production of advanced biofuels, and an unnecessary reduction in advanced biofuels would be antithetical to that intent. Second, harvest projections and other data strongly suggest that Brazilian sugarcane ethanol producers, along with other advanced biofuel producers who are expanding production around the world, can achieve the EISA's statutory volume requirement for 2013. Third, given the delay in the issuance of the proposed 2013 RFS2 Rule, much of the compliance year will be completed before a final rule is issued, and any significant changes would create hardship for the entities who, by default, were forced to act in reliance on the volume requirements in the proposed rule.

A. Maintaining the statutory volume requirement for advanced biofuels is consistent with the EISA's energy security and GHG reduction goals

When it passed the EISA in 2007, Congress made two significant changes to the RFS program that were intended to increase energy security and reduce GHG emissions. First, Congress extended and dramatically increased the statutory volume requirements for renewable fuels. For 2012, the last year covered under the original RFS program, the renewable fuels mandate more than doubled, from 7.5 to 15.2 billion gallons. Second, Congress established three nested subcategories of renewable fuels based on their superior lifecycle GHG emissions and included aggressive, technology-forcing statutory volume requirements for these subcategories. However, in recognition that producers may be unable to achieve the aggressive statutory volume requirements, Congress provided EPA with limited authority to waive portions of the mandate. Specifically, Congress gave EPA the authority to reduce the required volume of cellulosic biofuel when "the projected volume of cellulosic biofuel production is less than the minimum applicable volume established under paragraph (2)(B)." 42 U.S.C. § 7545(o)(7)(D)(i). EPA is proposing to exercise that authority here by reducing the cellulosic biofuel requirement from 1 billion gallons to 14 million gallons.[19] 78 Fed. Reg. at 9284. In the event that EPA waives a portion of the cellulosic biofuel mandate, the Agency also has the discretion to "reduce the applicable volume of renewable fuel and advanced biofuels requirement established under paragraph (2)(B) by the same or a lesser amount." 42 U.S.C. § 7545(o)(7)(D)(i).

[19] UNICA takes no position regarding EPA's projections regarding cellulosic ethanol production that were used to derive the proposed 14 million gallon requirement. UNICA has no reason to doubt the reasonableness of EPA's projections; however, because UNICA's members do not produce cellulosic biofuels, UNICA is not in a position to evaluate the basis for EPA's projections.

Clearly, congressional intent in creating these *advanced* biofuel categories and statutory volume requirements was to encourage innovation in biofuel technologies that would reduce GHG emissions as compared to the gasoline baseline. Indeed, the stated purposes of the EISA include "increas[ing] the production of clean renewable fuels." *See also* 74 Fed. Reg. 24,904, 25,021 (May 26, 2009) (explaining that the RFS2 Rule's requirements "are designed to ensure significant GHG emissions reductions from the use of renewable fuels and encourage the use of GHG-reducing renewable fuels"). Likewise, President Obama has repeatedly called on EPA encourage production of advanced renewable fuels in order to reduce dependence on foreign oil and to reduce GHG emissions.[20] The President's recently released *Blueprint for a Clean and Secure Energy Future* reiterated the key role that renewable fuels play in the President's all-of-the-above energy strategy.[21]

UNICA agrees with EPA that it "would not be consistent with the energy security and greenhouse gas reduction goals of the statute to reduce the applicable volume of advanced biofuel set forth in the statute if there are sufficient volumes of advanced biofuels available, even if those volumes do not include the amount of cellulosic biofuel that Congress may have desired." 78 Fed. Reg. at 9295. First, it is clear that in the event of a shortage of cellulosic biofuels, Congress intended EPA to replace the cellulosic biofuel volume requirement with other advanced biofuels, not conventional fuels. Had it intended otherwise, Congress would have required—rather than simply permitted—EPA to reduce the volumes of renewable fuels and advanced biofuels when granting a waiver for cellulosic biofuels. Second, EPA's waiver authority for cellulosic biofuels differs from other waiver provisions in the EISA, as the Agency is only instructed to consider the difference between projected biofuels production and the statutory volume requirement. In contrast, the provisions allowing EPA to waive portions of the renewable fuels volume and the biomass-based diesel volume require EPA to consider economic and environmental factors as well as production projections. 42 U.S.C. § 7545(o)(7)(A), (E). This difference strongly suggests that when considering whether partial waiver for advanced biofuels should accompany a waiver for cellulosic biofuels, EPA should focus *solely* on whether there will be sufficient supply of advanced biofuels to meet the EISA's statutory requirement. Thus, in any given year, if there is an insufficient volume of cellulosic biofuel available, but an ample volume of other advanced biofuels available with GHG emission reductions that are equal to or greater than the cellulosic threshold, EPA should not lower the required volume for advanced biofuels, but instead should transfer the requirement from cellulosic to the other advanced biofuel categories with available supply. To do otherwise would undermine Congress' purpose for the EISA by encouraging the use of fossil fuels and straining the important clean energy innovation taking place in laboratories and pilot facilities around the world.

[20] *See, e.g.,*, The White House Office of the Press Secretary, President Obama Announced Steps to Support Sustainable Energy Options, Departments of Agricultural and Energy, Environmental Protection Agency to Lead Efforts (May 5, 2009), *available at* http://whitehouse.gov/the_press_office/President-Obama-Announced-Steps-to-Support-Sustainble-Energy-Options/.

[21] The White House Office of the Press Secretary, FACT SHEET: President Obama's Blueprint for a Clean and Secure Energy Future (March 15, 2013), *available at* http://www.whitehouse.gov/the-press-office/2013/03/15/fact-sheet-president-obama-s-blueprint-clean-and-secure-energy-future.

B. Brazilian sugarcane ethanol producers are capable of exporting more than 666 million gallons of ethanol into the United States in 2013

In the proposed rule, EPA suggests that Brazilian sugarcane ethanol producers will need to export 666 million gallons of ethanol to the United States to achieve the EISA's 2.75 billion gallon mandate for advanced biofuels. 78 Fed. Reg. at 9298. Based on projections derived from UNICA's harvest estimates and bi-weekly updates, EPA projects that Brazilian sugarcane ethanol producers can export at least 666 million gallons to the United States. Nevertheless, EPA notes several areas of uncertainty that could potentially reduce Brazilian sugarcane ethanol production and/or exports to the United States. Since the proposed 2013 RFS2 Rule was issued, projections for Brazilian ethanol exports to the United States have improved dramatically as the 2012/2013 harvest is complete and preliminary estimates for the 2013/2014 sugarcane harvest are now available. These improved metrics confirm that Brazilian sugarcane ethanol producers will be capable of exporting more than 666 million gallons of ethanol to the United States in 2013. Given the dramatic reduction in uncertainty over the past few months, there is no basis for reducing the advanced biofuels volume requirement due to uncertainty regarding Brazilian sugarcane ethanol exports.

1. Harvest projections show that sugarcane crop yields have improved and will provide sufficient feedstocks to achieve EPA's projections for Brazilian sugarcane ethanol exports to the United States

EPA's projections in the proposed 2013 RFS2 Rule for Brazilian sugarcane ethanol production were based on preliminary harvest estimates and mid-season harvest data provided by UNICA. Based on those limited data, EPA concluded that Brazilian sugarcane ethanol producers would be able to export at least 666 million gallons of ethanol to the United States. At the same time, however, EPA noted that "there remains some uncertainty in the volumes of sugarcane ethanol that could be produced in Brazil in 2013." 78 Fed. Reg. at 9299. While UNICA agrees that EPA has made reasonable assumptions about Brazilian ethanol exports to the United States, we believe that much of the residual uncertainty has been resolved. The 2012/2013 sugarcane harvest season in the South-Central region is now complete and UNICA is in the process of preparing initial harvest projections for the 2013/2014 season.[22] The updated sugarcane harvest and ethanol production data show that Brazil's capacity to export ethanol to the United States will exceed EPA's estimates of 666 million gallons for 2013.

In the proposed 2013 RFS2 Rule, EPA expressed optimism that sugarcane production in Brazil would expand due to improved weather and increased investments in replanting. *Id.* at 9298. EPA suggested that improved weather alone could increase harvests by approximately 4%. *Id.* Revised harvest reports for the 2012/2013 season confirm EPA's projections. 2012/2013 sugarcane harvest for the South-Central region, which produces approximately 90% of Brazil's sugarcane, increased by 8% to 533 million tons when compared to the 2011/2012 season.[23] UNICA also projects a

[22] The South-Central harvest season runs from April to March, while the harvest season in the North-Northeast region runs from September to August.

[23] UNICA, "Harvest update: Biweekly Bulletin," Mar. 16, 2013 ("UNICA March 16 Biweekly Bulletin"), attached as Exhibit C, *available at* http://www.unicadata.com.br/listagem.php?idMn=63&idioma=2.

significant increase sugarcane production for the 2013/2014 season, with total harvests in the South-Central region reaching 590 million tons, an 11% increase over the 2012/2013 season.[24] As shown in Figure 1, below, UNICA's projections are consistent with those from other respected organizations analyzing Brazil's sugarcane crop. The North-Northeast region's sugarcane harvest for the 2013/2014 season is expected to decline slightly from the 2011/2012 season, by approximately 10 million tons.[25] However, harvests will remain near historic levels and the year-over-year decline is small compared to the increases in the South-Central region. Further, given the semi-perennial nature of sugarcane crop, where replanting occurs only every 5-7 years, such variations are expected and have been included in most models to project sugarcane production, including those used by UNICA in its prior comments to EPA.

Figure 1: Projections for 2013/2014 Sugarcane Harvest

	Product	**Source**					
		Datagro	FOLicht	Czarnikow	Kingsman	UNICA[a]	Average
South-Central region	Sugarcane crushing[b]	587	585	580	585	590	585
	Sugar production[b]	36.6	35.6	35	35.5	35	35.5
	Ethanol production[c]	6.6	6.7	6.7	6.6	6.7	6.5
Total Brazil	Sugarcane crushing[b]	647	645	640	645	650	645
	Sugar production[b]	40.7	39.7	39.1	39.6	39.1	39.6
	Ethanol production[c]	7.1	7.1	7.2	7.1	7.1	7.1

Notes: [a] Preliminary estimate, [b] million tons, [c] billion gallons

Likewise, sugarcane ethanol production in Brazil will exceed EPA's projections. In the proposed 2013 RFS2 Rule, EPA 's projections for ethanol production were based on UNICA's September 2012 harvest estimates and December 1, 2012 biweekly report. 78 Fed. Reg. at 9298. UNICA's September 2012 ethanol production estimate for the South-Central region was 5.56 billion gallons, which EPA used to project a nation-wide production value of 6.1 billion gallons. *Id.* UNICA's December 1, 2012 biweekly report showed a small year-over-year increase in ethanol production of 0.55% compared to the 2011/2012 harvest. *Id.* Ethanol production increased dramatically at the end of the 2012/2013 season. Revised production reports show a 4% year-over-year increase in ethanol production in the South-Central region[26] and ethanol production in the region will

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[24] UNICA is currently in the process of developing official projections for the 2013/2014 harvest season and expects to publicly announce those projections near the end of April. We do not anticipate that the officially released estimates will vary significantly from the preliminary, unofficial estimates that we are providing here. Given the importance of these projections for EPA's rulemaking, we provide EPA with the most up to date information available, even if it is currently unpublished. Further, UNICA intends to supplement this record and provide official, published projections for the 2013/2014 once they are available.

[25] DATAGRO and Ministry of Agriculture, Food Supply and Livestock - http://mapas.agricultura.gov.br:81/Spc/daa/Resumos/ACOMPANHAMENTO_PRODUCAO_01_09_2012_11-12.pdf)

[26] UNICA March 16 Biweekly Bulletin.

exceed 5.64 billion gallons,[27] a 1.5% increase over UNICA's September 2012 estimate. Further UNICA's preliminary estimates suggest that ethanol production in the South-Central region will grow by an additional 18-20% in 2013/2014.[28]

This growth in ethanol production will significantly increase the amount of Brazilian sugarcane ethanol available for export. Ethanol exports for the 2012/2013 harvest season have been robust, exceeding 900 million gallons through February 2013.[29] This represents an 80% increase over the 2011/2012 harvest season[30] and is nearly double the USDA estimate of 500 million gallons that was cited by EPA in the proposed 2013 RFS2 Rule. 78 Fed. Reg. at 9299. Ethanol exports from the South-Central region have been especially strong since the beginning of 2013 and have increased by more than 350% as compared to the same period in 2012.[31] Further, ethanol exports are expected to increase even more for the 2013/2014 season. As described more fully below, even after accounting for a potential increased demand in Brazil, UNICA projects that ethanol exports from the South-Central region could grow by as much as 800 million gallons.[32]

Based on this updated data for the 2012/2013 season and UNICA's preliminary estimates for the 2013/2014 season, UNICA is confident that Brazilian sugarcane ethanol producers will be able to meet—and if necessary surpass—EPA's projections for Brazilian sugarcane ethanol exports to the United States. Further, we believe this updated information resolves any residual uncertainty regarding Brazilian sugarcane production and ethanol production and obviates any need to reduce the statutory volume requirement for advanced biofuels as a hedge against poor production in Brazil.

2. Brazilian demand for ethanol will not create a barrier to achieving EPA's projections for ethanol exports to the United States

In the proposed 2013 RFS2 Rule, EPA suggests that increased demand for sugarcane ethanol in Brazil could reduce the amount of ethanol available for export to the United States. 78 Fed. Reg. at 9299. Specifically, EPA expressed concern that Brazil could increase its ethanol-blending requirement from 20% to 25%. *Id.* On March 1, 2013 the Brazilian government did indicate that the required ethanol blend would be increased from 20% to 25%, with an effective date of May 1, 2013.[33] The May 1

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[27] *Id.*

[28] UNICA, Preliminary projections, to be supplemented with official, published projections.

[29] AliceWeb, Brazilian Secretariat of Foreign Trade, *available at* http://aliceweb.desenvolvimento.gov.br.

[30] *Id.*

[31] UNICA March 16 Biweekly Bulletin. Sugarcane exports from Brazil fluctuate throughout the harvest season, and reach peak levels from June to November. *Id.* Table 9. As a result, year-to-date export volumes that rely on January to March data will not provide accurate estimates of total exports for 2013.

[32] UNICA, Preliminary projections, to be supplemented with official, published projections.

[33] Dom Phillips, "Brazil to raise ethanol mix in gasoline to 25% from 20% May 1," *Platts* (Mar. 1, 2013), *available at* http://www.platts.com/RSSFeedDetailedNews/RSSFeed/Oil/8194390.

effective date was scheduled to coincide with the 2013/2014 sugarcane season, at which time the government believes it will have full clarity on production and demand volumes. (As noted in prior comments to EPA, the Brazilian law allows the government discretion on the blend of anhydrous ethanol in gasoline, which can range from 20% to 25%.[34] This discretion is not a new policy and has been invoked often in years past, sometimes for reasons unrelated to fuel supply, such as inflation targeting as well as food security. UNICA believes this policy has provided the flexibility that has made Brazil's renewable fuels policy so resilient over the past several decades.) While UNICA appreciates EPA's concern that increased ethanol demand in Brazil could reduce Brazil's capacity to export ethanol, UNICA remains confident that Brazilian sugarcane ethanol producers will be able to meet EPA's projections in the proposed 2013 RFS2 Rule regardless of changes in the blend levels in Brazil.

As an initial matter, the shift to E25 in Brazil will not take place until May 1, 2013 and thus will not impact export capacity associated with the 2012/2013 harvest season. Further, despite the increase in Brazilian demand for ethanol during the 2013/2014 harvest season, UNICA projects that export capacity will also increase. Given the prevalence in Brazil of flex-fuel vehicles that already utilize hydrous ethanol blends of up to 100%, the 25% anhydrous ethanol requirement in gasoline will have a relatively minor impact on Brazilian demand. UNICA projects that the E25 mandate will require an additional 528 million gallons (2 billion liters) of ethanol.[35] However, UNICA projects that total Brazilian sugarcane ethanol production will increase by 0.8 to 1.3 billion gallons (3 to 5 billion liters) in 2013/2014 and will far exceed the increase in domestic demand.[36] As a result, even after accounting for increased demand in Brazil, UNICA projects that export capacity will increase by between 264 and 792 thousand gallons (1 and 3 billion liters). Thus UNICA remains confident that Brazilian sugarcane ethanol producers will be able to achieve EPA's export projections for 2013 and will likely have capacity to increase exports in 2014 in response to the EISA's increased volume requirements for advanced biofuels in the coming years.

3. Neither world sugar prices nor international demand for Brazilian ethanol will prevent Brazilian ethanol producers from meeting EPA's projections for sugarcane ethanol exports to the United States

In the proposed 2013 RFS2 Rule EPA also expressed concern that other global market forces could limit Brazilian sugarcane ethanol exports to the United States. Specifically, EPA noted uncertainties related to world sugar prices and international demand for biofuels. 78 Fed. Reg. at 9285. While global markets forces do have an effect on Brazilian sugarcane ethanol production and distribution, UNICA is confident that Brazilian sugarcane ethanol producers will be able to meet EPA's projections for exports to the United States.

As EPA notes in the proposed rule, increasing sugar prices can have a marginal impact on ethanol production by creating incentives to divert sugarcane crops from ethanol production to sugar production. However, the global trends in sugar prices have

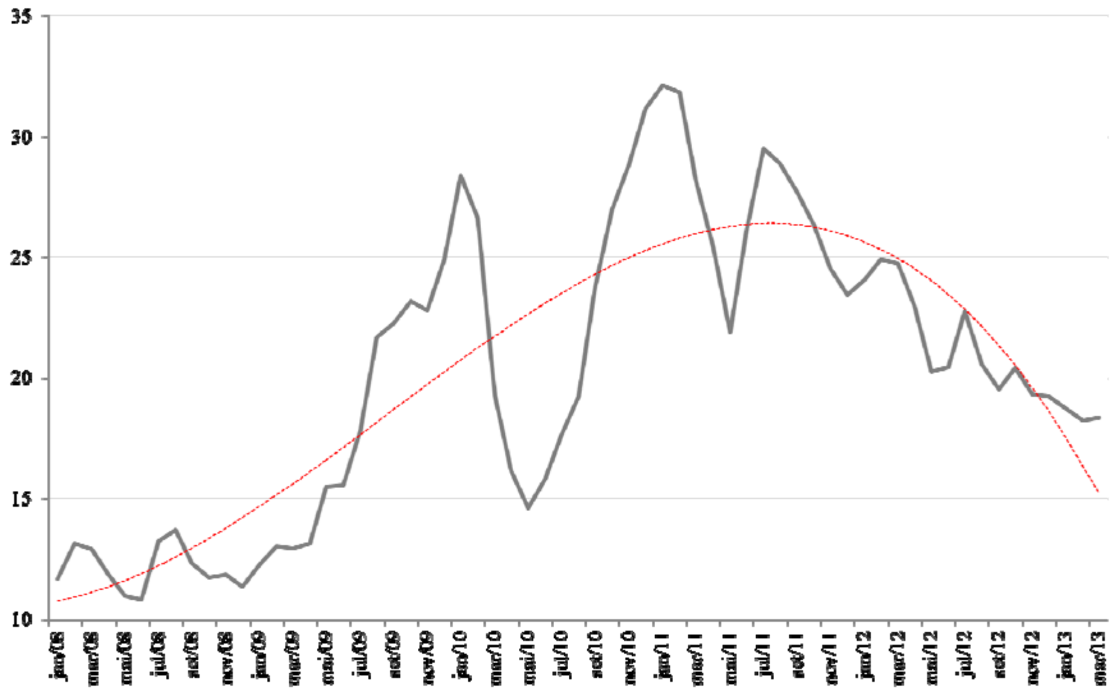
[34] UNICA, E15 Petition Comments at 5.

[35] UNICA, Preliminary projections, to be supplemented with official, published projections.

[36] UNICA, Preliminary projections, to be supplemented with official, published projections.

recently reversed, with New York No. 11 raw sugar price index declining by 36% from the first quarter of 2011 to the fourth quarter of 2012.[37] *See* Figure 2. Based on this recent downward trend in sugar prices, UNICA is projecting that the share of the sugarcane crop dedicated to ethanol production will increase in the 2013/2014 season. While UNICA is projecting about a 10% increase in total sugarcane production in the South-Central region, ethanol production is expected to increase by 18-20%.[38] In contrast, sugar production is only expected to increase by 3%.[39] Thus, changes in global sugar prices are projected to increase, rather than decrease, the available supply of Brazilian sugarcane ethanol.

Figure 2: New York No. 11 Raw Sugar Price Index



Source: Intercontinental Exchange, Inc.,

EPA also notes that the United States competes with the European Union and other locations for exported Brazilian sugarcane ethanol. However, UNICA does not believe that this apparent competition will prevent Brazil from exporting sufficient quantities of sugarcane ethanol to the United States to meet EPA's projections for 2013. First, while United States demand for Brazilian sugarcane demand may increase due to the EISA's increased volume mandates, UNICA does not believe that other international regulatory changes will alter materially world-wide demand for Brazilian sugarcane ethanol. As result, we would expect current trends in export volumes to continue, unless

[37] New York No. 11 raw sugar price data was obtained from Intercontinental Exchange, Inc., available at https://www.theice.com/productguide/ProductSpec.shtml?specId=23 (last visited April 5, 2013).

[38] UNICA, Preliminary projections, to be supplemented with official, published projections.

[39] UNICA, Preliminary projections, to be supplemented with official, published projections.

increased demand from the United States increases the proportion of exports to the United States. For the 2012/2013 harvest season, Brazil has exported 592 million gallons of sugarcane ethanol to the United States, representing two-thirds of total Brazilian exports. Assuming that current export trends continue, exports to the United States would be expected to increase by a minimum of 176 million gallons and far exceed the 666 million gallons that EPA projects will be needed to meet the EISA's statutory volume requirement for advanced biofuels. Thus, based on current export trends and projected increases in export capacity, UNICA is confident that global demand for Brazilian sugarcane ethanol will not pose a barrier to meeting EPA's export projections for 2013.

4. There is no need to reduce the statutory volume requirement for advanced biofuels to account for uncertainty in Brazilian sugarcane ethanol production

Despite its optimism that 666 million gallons of Brazilian sugarcane ethanol would be available for export to the United States, EPA expressed concern over residual uncertainty regarding Brazilian sugarcane ethanol production and requested comment on whether this uncertainty warranted a reduction in the volume requirement for advanced biofuels. 78 Fed. Reg. at 9301 ("[T]here may be enough uncertainty to warrant a more cautious approach to advanced biofuel and total renewable fuel in 2013, for example a reduction of 200 mill gal to approximate the uncertainty discussed above."). In light of the updated harvest, ethanol production, and export data provided by UNICA in these comments, we believe that there is no basis for a reduction based on uncertainty in Brazilian sugarcane ethanol supplies. The revised data provided here exceed by a considerable margin the projections used in the proposed 2013 RFS2 Rule and demonstrate conclusively that Brazilian sugarcane ethanol producers have the capacity to export sufficient quantities of ethanol to ensure that the 2013 advanced biofuel mandate will be met. Therefore, UNICA urges EPA to maintain the statutory volume requirements for advanced biofuels in the final 2013 RFS2 Rule.

C. EPA's projections for other categories of advanced biofuels are conservative and provide an adequate backstop to mitigate any residual uncertainty related to Brazilian sugarcane ethanol production

While UNICA is confident that Brazilian sugarcane ethanol producers will have sufficient export capacity to achieve EPA's projections for ethanol exports to the United States, we appreciate that EPA's final decision regarding the volume requirements for advanced biofuels will also depend on EPA's projections for other advanced biofuel sectors. Developing production estimates for other advanced biofuels is beyond UNICA's mission and we cannot provide EPA with any independent data to support EPA's projections. However, based on our evaluation of the proposed 2013 RFS2 Rule, it appears that EPA's projections for other advanced biofuel sectors are reasonable and quite possibly conservative. By taking such a conservative approach for 2013 RFS2 rulemaking, we believe EPA has already incorporated an ample margin for error with respect to advanced biofuel production that will ensure that aggregate advanced biofuel production will meet the statutory requirements, even if there is some residual uncertainty for specific sectors.

First, EPA's projections only include 1.28 billion gallons of biomass-based diesel, which is equal to the statutory requirement for 2013. *See* 77 Fed. Reg. 59,457 (Sept.

27, 2012).[40] Nevertheless, EPA asserts that "biomass-based diesel volumes above 1.28 bill gal are possible" and notes that aggregate production capacity in the United States is more than 2 billion gallons. 78 Fed. Reg. at 9296 (citing EIA, Monthly Biodiesel Production Report (Dec. 2012)). Thus, there is capacity for significantly more biomass-based diesel production than EPA is currently projecting. Second, EPA's projections for other undifferentiated advanced biofuels may also be conservative. EPA based its projection for 150 million gallons on production estimates from registered producers. *Id.* at 9297. This estimate is 30 million gallons lower than the estimate from E2/Environmental Entrepreneurs, *id.* at 9298, and does not include any production from new market entrants. Further, EPA's estimate does not include any production from additional pathways currently under consideration by the Agency. EPA explains that approval of such pathways could increase production of advanced biofuel by up to 200 million gallons. *Id.* at 9298. While UNICA defers to EPA's production estimates for other advanced biofuels, we believe that the conservative approach taken by EPA, coupled with UNICA's revised data for Brazilian sugarcane ethanol, justifies maintaining the EISA's statutory 2.75 million gallon volume requirement for advanced biofuels for 2013.

IV. EPA lacks authority to consider extraneous issues beyond Congress' purpose in the EISA when establishing volume requirements for advanced biofuels

The RFS2 program, which was established in the EISA, is one of several Congressional initiatives that promotes or otherwise impacts the use of renewable fuels in the United States. Because they all address the same subject matter, these programs can interact in complicated and sometimes unexpected ways. Still, when implementing each program, EPA must remain mindful of the program-specific Congressional mandate that it is bound to follow and must avoid consideration of extraneous factors and influences that may arise due to other federal programs. While overlapping and potentially inconsistent Congressional mandates can make implementation of renewable fuels programs challenging, EPA must not exceed its delegated authority when implementing each program. Thus, to the extent that the RFS2 program creates implementation challenges for other programs, it is Congress—not EPA—who must take action to reconcile the conflicting mandates. Unless and until Congress acts to expand the factors that EPA may consider when issuing volume waivers under the RFS2 program, EPA should not consider such extraneous issues as two-trade in ethanol between the United States and Brazil or the effect of tax incentives such as the biodiesel tax credit.

A. It is arbitrary and capricious for EPA to rely on issues that Congress did not intend for it to consider

It is a well-established principle of administrative law that a federal agency's discretion is bounded by the scope of the mandate provided by Congress. Thus, an agency action will be deemed arbitrary and capricious unless "the decision was based on a consideration of the relevant factors." *Citizens to Preserve Overton Park, Inc. v. Volpe*, 401, U.S. 402, 416 (1971). Expanding on this straightforward definition, the Supreme Court explained:

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[40] Because biomass-based diesel generates 1.5 RINs per gallon of fuel produced, meeting the statutory volume requirement will count as 1.92 billion gallons toward the advanced biofuels mandate.

> an agency rule would be arbitrary and capricious if the agency has *relied on factors which Congress has not intended it to consider,* entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.

Motor Vehicle Mfrs. Ass'n of the United States, Inc. v. State Farm Mut. Ins. Co., 463 U.S. 29, 43 (1983) (emphasis added). Under this standard, an agency's discretion is limited to the scope of its delegated authority and the agency cannot add additional factors to guide its decision-making process. For example, in *Whitman v. American Trucking Ass'ns, Inc.*, 531 U.S. 457 (2001), the Supreme Court affirmed the D.C. Circuit's holding that EPA impermissibly considered costs when setting National Ambient Air Quality Standards ("NAAQS") for ozone. Unlike other provisions in the Clean Air Act, the provisions regarding NAAQS do not specifically permit EPA to consider costs and the court found this omission intentional in light of other specific provisions authorizing EPA to consider costs.

EPA asserts in the proposed 2013 RFS2 Rule that the "[t]he statute does not provide any explicit criteria that must be met or factors that must be considered when making a determination as to whether and to what degree to reduce the advanced biofuel and total renewable fuel applicable volume when we have the discretion under CAA 211(o)(7)(D)(i) to do so." 78 Fed. Reg. at 9295. However, this does not mean that EPA has *carte blanche* to consider any factors it chooses. *See*, *American Trucking*, 531 U.S. at 472 (a statute violates the non-delegation doctrine unless Congress provides an "intelligible principle" to guide agency action). Here, as EPA has appropriately determined, Congress' purpose in the EISA to promote energy security and reduce GHG emissions provides implicit criteria for the cellulosic biofuels waiver that require EPA to focus solely on the question of whether there are sufficient volumes of advanced biofuel available to meet the statutory limit. 78 Fed. Reg. at 9295. Further, even under a broad approach that considered the EISA's waiver provisions as a whole, EPA's discretion would still be limited to considering (1) the available volume of advanced biofuel, (2) harm to the economy or environment of the United States or a region thereof, or (3) market conditions that would significantly increase the price of advanced biofuels. *See* 42 U.S.C. § 7545(o)(7)(A), (D), (E). Nothing in the EISA suggests that EPA should consider the impact on renewable fuels mandates in other countries, the effect on competing fuel products, or the impact of other laws that address issues related to renewable fuels.

B. Two-way trade in ethanol between the United States and Brazil is not relevant to EPA's decision regarding the applicable volume of advanced biofuels for 2013

In the proposed 2013 RFS2 Rule, EPA references two-way trade in ethanol between the United States and Brazil. *See* 78 Fed. Reg. at 9286, 9299. This trade involves the import of an advanced biofuel—Brazilian sugarcane ethanol—into the United States, and the export of a renewable fuel—corn ethanol[41]—to Brazil. Some have argued that this two-way trade in ethanol in inefficient and should be stopped,

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[41] Under the EISA, "ethanol derived from corn starch" cannot quality as an advanced biofuel. 42 U.S.C. § 7545(o)(1)(B)(i).

presumably by increasing consumption of advanced biofuels in Brazil and by increasing consumption of corn ethanol in the United States.[42] However, no matter how interesting it may be as an abstract policy matter, the export of United States corn ethanol to Brazil is simply not germane to EPA's decision-making process under the RFS2 program.

The fact that there is two-way trade in ethanol between the United States and Brazil demonstrates both the complexity and success of government intervention into fuel markets. As an initial matter, two-way trade in ethanol would be much less likely to occur in the absence of government laws and regulations promoting renewable fuels. These laws and regulations have played a significant role in the growth of both Brazilian sugarcane ethanol production and United States corn ethanol production. But, because the laws and regulations are not uniform across jurisdictions, divergent market incentives for sugarcane and corn ethanol can make two-way trade in ethanol more likely. However, it does not follow that EPA must address this issue at all, much less in the 2013 RFS2 Rule.

As explained above, Congress had two policy objectives in passing the EISA and establishing the RFS2 program: (1) promoting energy security and (2) reducing GHG emissions by shifting consumption from fossil fuels to renewable fuels. Further, by creating separate volume mandates for advanced biofuels, biomass-based diesel, and cellulosic biofuels, Congress intended to create market incentives that favored these types of renewable fuels over corn ethanol, which produces fewer lifecycle GHG benefits. Thus, as EPA correctly concludes, the relevant question that the Agency must answer here is whether there is a sufficient supply of advanced biofuels—produced domestically or exported to the United States—to achieve Congress' goals for advanced biofuel consumption in the United States. It is simply irrelevant to EPA's analysis whether other nations have also created market incentives to promote renewable fuels and whether any of that demand is met by exporting domestic fuels that do not qualify as advanced biofuels.

Nor do the GHG emissions associated with two-way trade between Brazil and the United States provide an independent basis for evaluating two-way ethanol trade in this rulemaking. First, EPA's lifecycle analysis for Brazilian sugarcane ethanol already incorporated GHG emissions associated with the transport of ethanol from Brazil to the United States. Even after including those emissions, EPA concluded that Brazilian sugarcane ethanol offered significant GHG benefits when compared to the gasoline baseline and classified it as an advanced biofuel. Second, emissions associated with the transportation of sugarcane ethanol to the United States constitute an insignificant portion of total lifecycle GHG emissions. For example, the California Air Resources Board concluded that total emissions associated with the transport and distribution of sugarcane ethanol from Brazil to California were only 1.9% of lifecycle emissions.[43] Third, any GHG emissions associated with the export of domestically produced corn ethanol to Brazil cannot be attributed to the RFS2 program or to EPA's decision regarding the 2013 volume requirements for advanced biofuels. Instead those

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[42] *E.g.*, Geoff Cooper, *The Ethanol Shuffle* (Dec. 12, 2011), *available at* http://www.ethanolrfa.org/exhange/entry/the-ethanol-shuffle/.

[43] CARB (California Agency Air Resources Board), 2009. Detailed California-Modified GREET Pathways for Brazilian Sugarcane Ethanol: Average Brazilian Ethanol, With Mechanized Harvesting and Electricity Co-product Credit, With Electricity Co-product Credit version 2, *available at* http://www.arb.ca.gov/fuels/lcfs/092309lcfs_cane_etoh.pdf.

emissions should be attributed to the market conditions that produced them, namely excess supply of domestic corn ethanol and policies in Brazil that encourage the export of United States ethanol to Brazil.

Thus, even if two-way trade in ethanol between the United States and Brazil were deemed inefficient or otherwise undesirable from a market standpoint,[44] it should not be considered by EPA because it falls outside of EPA's delegated authority under the RFS2 program. As a result, it would be arbitrary and capricious for EPA to consider this two-way trade when setting applicable volume requirements for advanced biofuels. Therefore, unless and until Congress takes action directing EPA to include two-way trade in ethanol as part of its decision-making process under the RFS2 program, the Agency should simply ignore the export of excess domestic supplies of corn ethanol and focus solely on the volume of advanced biofuel that will be available in United States.

C. EPA should not consider the short-term biodiesel tax credit when setting the 2013 volume requirements for advanced biofuels

In January 2013 Congress temporarily reinstated the biodiesel tax credit that had expired in 2011, applying it retroactively to 2012 and prospectively to 2013. In the proposed 2013 RFS2 Rule, EPA requested comment "on what effect the tax credit will have on the advanced biofuel production volumes and the [sic] whether this would affect the incentives to import sugarcane ethanol and to what extent." 78 Fed. Reg. at 9297. For the reasons below, EPA should not consider the effects of this temporary tax credit when setting volume requirements for advanced biofuels under the RFS2 program.

As an initial matter, it would be arbitrary and capricious for EPA to consider the impact of the biodiesel tax credit as it pertains to the fuel mix used to achieve the 2013 volume requirement for advanced biofuels. As described above, the principle question that EPA must answer in this rulemaking is whether there will be a sufficient supply of advanced biofuels available to meet the EISA's statutory volume requirement for 2013. The fact that Congress elected to provide additional incentives and preferential treatment for biodiesel by passing a temporary and belated extension of the biodiesel tax credit is outside the factors that EPA can consider when deciding whether to waive a portion of the advanced biofuels mandate.[45] While the EISA and the 2013 biodiesel tax credit extension create incentives for renewable fuel production that may overlap in some circumstances, these incentives are administered by different agencies, and Congress has not instructed EPA to harmonize the two programs. Absent such a mandate, it would be arbitrary and capricious for EPA to base its decision in the 2013 RFS2 Rule on the impact of the unrelated biodiesel tax credit.

Despite the fact that the biodiesel tax credit is beyond the scope of EPA's review here, UNICA provides the following response to EPA's question. First, as a general matter, UNICA opposes the biodiesel tax credit as an unnecessary restraint on free trade within the advanced biofuel sector. The tax credit effectively subsidizes the

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[44] When considered in the broader context of overall trade between the United States and Brazil, as well as the logistics of domestic ethanol transport within each State, two way trade in ethanol between Brazil and the United State may in fact be efficient from a market standpoint.

[45] The only potential relevance for the 2013 biodiesel tax credit would relate to increases in biodiesel production, not the competitive impact on other advanced biofuels such as Brazilian sugarcane ethanol.

production of domestic advanced biofuels and creates an artificial competitive advantage at the expense of foreign advanced biofuels such as Brazilian sugarcane ethanol. In this respect, the biodiesel tax credit will alter the incentives to use Brazilian sugarcane ethanol to achieve the 2013 advanced biofuels mandate, although the scope of that impact remains uncertain. However it is important to note that these incentives will alter the *demand* for Brazilian sugarcane ethanol, not the available *supply*. As described above, Brazilian sugarcane ethanol producers have the capacity to meet EPA's projections for sugarcane ethanol exports to the United States. While a reduction in demand due to increased competition from biodiesel may cause Brazilian sugarcane ethanol producers to seek other markets for their products, it will not diminish the supply of advanced biofuels available to meet the 2013 RFS2 mandate.

Second, reliance on the 2013 biodiesel tax credit would be inconsistent with the overarching purpose of the EISA and RFS2 program. In the EISA, Congress established a long-term commitment to promoting a balanced mix of advanced biofuels that includes undifferentiated biofuels such as Brazilian sugarcane ethanol as well as cellulosic biofuels and biomass-based diesel. In response, Brazilian sugarcane ethanol producers, along with others in the advanced biofuels sector, have made long-term commitments to increasing production capacity and ensuring a long-term supply of the products mandated by Congress. In contrast, the biodiesel tax credit provides short-term, and sometimes retroactive support for the biodiesel sector. These short-term and uncertain subsidies disrupt, rather than promote the EISA's long-term goals of promoting growth and stability within the advanced biofuels sectors. EPA should ignore these fleeting impacts when establishing policies under the RFS2 program.

V. EPA should not reduce the 2014 statutory volume requirements for advanced biofuels at this time

Although EPA has proposed to maintain the statutory volume requirements for advanced biofuels for 2013, the Agency expressed concern that the advanced biofuel producers may not be able to increase production by an additional 1 billion gallons in 2014 as required by the EISA. In the proposed 2013 RFS2 Rule, EPA requested comment "on whether such a reduction should be considered in 2014, the basis for such a reduction, and the amount of that reduction." 78 Fed. Reg. at 9301. UNICA appreciates EPA's concern that the aggressive increases in advanced biofuel production mandated by Congress may pose challenges for advanced biofuel producers. We also support EPA's decision to take early action to consider its regulatory options in the event that there is an insufficient supply of advanced biofuels to achieve Congress' goals. Taking prompt action with respect to the 2014 volume requirements—by the November 30 deadline—will be essential to providing advanced biofuel producers with sufficient notice to meet the volume requirements that EPA ultimately sets for 2104. At the same time, we believe that any decisions at this time would be premature as uncertainty regarding 2014 production will be reduced as we approach the November 30 deadline.

As an initial matter, UNICA is committed to working with EPA to develop accurate estimates for Brazilian sugarcane harvests and ethanol exports to the United States. At the time of this submission, UNICA is preparing to issue its initial harvest projections for the 2013/2014 sugarcane harvest, which project an increase in ethanol production of up to 1.32 billion gallons.[46] Based on these initial projections, we believe it is reasonable to

[46] UNICA, Preliminary projections, to be supplemented with official, published projections.

assume that Brazilian sugarcane producers may be capable of exporting as much as 800 million additional gallons of sugarcane ethanol to the United States in 2014.[47] UNICA expects that these projections will be revised throughout the year in response to growing conditions and competing demand for sugarcane products. We look forward to working with EPA in the coming months to develop accurate projections for Brazilian sugarcane ethanol exports to the United States in 2014.

Further, we believe that the uncertainty surrounding production of other advanced biofuels warrants a cautious approach at this time. First, with respect to cellulosic biomass, EPA identified a number of facilities that are expected to begin production in either 2013 or 2014. Deferring a decision until closer to the November 30 deadline will provide EPA with much better estimates of the volume of cellulosic biofuel that will be available in 2014. Likewise, with respect to biodiesel, EPA notes that current capacity exceeds production by nearly 1 billion gallons. Temporarily deferring any decision will allow EPA to develop better data regarding the likelihood that currently idled production capacity will be recommissioned in response to increased demand. Deferring a decision will also increase the chances that Congress will address whether to extend the biodiesel tax credit before EPA sets volume requirements under the RFS2 program. Finally, with respect to other advanced biofuels, deferring a decision until closer to the November 30 deadline will provide EPA with more time to reach a decision regarding other pathways currently under consideration and to incorporate any increases in production based on those changes.

In sum, UNICA agrees with EPA that the rapid increases in the statutory volume requirements for advanced biofuel could pose challenges for advanced biofuel producers in the future. While UNICA projects that Brazilian sugarcane ethanol producers could potentially provide an additional 800 million gallons of export capacity in 2014, it is beyond our expertise to project whether other producers will be able to supply the additional capacity that will be required. While we applaud EPA for beginning this dialogue with interested stakeholders, we urge the Agency to develop as much additional data as possible before making a decision by the statutory November 30 deadline.

Conclusion

UNICA appreciates the opportunity to submit these comments in support of EPA's proposal to maintain the statutory volume requirements for advanced biofuels and is confident that Brazilian sugarcane ethanol producers can meet or surpass EPA's projections for ethanol exports to the United States. We urge EPA to issue a final rule as soon as possible to provide certainty to the producers and consumers of advanced biofuels who will be impacted by the final rule. UNICA is standing by to provide further information or answer any questions that EPA may have and to continue its cooperative role with EPA in ensuring that the Agency is able to realize and achieve the goals set by Congress and EPA in implementing the RFS2 program.

[47] UNICA, Preliminary projections, to be supplemented with official, published projections.

Respectfully Submitted,

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EXHIBIT A

BRAZILIAN SUGARCANE INDUSTRY ASSOCIATION
ETHANOL • SUGAR • ELECTRICITY

September 25, 2009

VIA ELECTRONIC MAIL

Environmental Protection Agency
Air and Radiation Docket and Information Center
Mailcode 2822T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Submission of Comments
Regulation of Fuels and Fuel Additives:
Changes to Renewable Fuel Standard Program
Docket EPA-HQ-OAR-2005-0161

To Whom It May Concern:

The Brazilian Sugarcane Industry Association (UNICA) is pleased to provide comments on the U.S. Environmental Protection Agency (EPA) proposed rulemaking for the Renewable Fuel Standard program (the "RFS2 Proposed Rule"). *See Proposed Rulemaking, Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program, 74 Fed. Reg. 24903 (May 26, 2009).*

In short, UNICA supports EPA's proposed RFS2 rulemaking and believes EPA should finalize RFS2 at the earliest opportunity. At the same time, UNICA respectfully raises specific issues and considerations below that we believe improve the implementation of the RFS2 Proposed Rule and achieve the energy security and greenhouse gas reduction goals sought by the Energy Security and Independence Act of 2007 (EISA).

UNICA is the largest organization representing sugar, ethanol, and bioelectricity producers in Brazil. UNICA's members are responsible for more than 50% of all ethanol produced in Brazil and 60% of overall sugar production. UNICA's priorities include serving as a source for credible scientific data about the competitiveness and sustainability of sugarcane biofuels. The association works to encourage the continuous advancement of sustainability throughout the sugarcane industry and to promote ethanol as a clean, reliable alternative to fossil fuels. In fact, gasoline is now the alternative fuel in Brazil, with more ethanol consumption than gasoline. In terms of sustainability, sugarcane ethanol production uses about 1% of Brazil's arable land and reduces greenhouse gases (GHG) by 90% compared to conventional gasoline. Moreover, thanks to our innovative use of ethanol in transportation and biomass for power cogeneration, sugarcane is now the number one source of renewable energy in Brazil, representing 16% of the country's total energy needs. And this industry is expanding existing production of

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renewable, carbon neutral plastics and, with the help of innovative companies here in the United States and elsewhere, will soon offer bio-based hydrocarbons that can replace carbon-intensive fossil fuels.[1]

Given our extensive experience with and knowledge of sugarcane biofuels production, and given our direct and significant interest in the final RFS2 rule, we request that EPA carefully and thoroughly consider this letter and its various references[2] in finalizing the rule. Based on the conservative results of a Brazil-specific model for calculating "indirect" emissions[3] and the minimum changes required for the "direct" emissions,[4] the revised results for the sugarcane ethanol pathway should be revised to 82 percent and 73 percent for 100 year with a 2% discount rate and 30 years with no discount rate, respectively. In fact, as our comments below as well as other international reports highlight, there is ample reason to believe that GHG reductions may well be even greater in the years ahead.

This letter is structured as follows: *First*, we provide an overview of the Brazilian sugarcane production and its use as a renewable, environmentally sound, and low carbon feedstock, addressing both its benefits and rebutting some erroneous presumptions. *Second*, we address the urgency for EPA to finalize the rule at the earliest opportunity while improving upon a few key issues in a timely way. *Third*, we discuss how EPA's technical lifecycle analysis understates the GHG benefits of sugarcane as a renewable feedstock and suggest specific revisions based on available, creditable scientific data and analysis. *Fourth*, we request reconsideration of various compliance mechanisms that EPA is proposing in order to address possible violations of international trade rules. The letter ends with a brief summary of recommended actions we respectfully request EPA undertake prior to final rule.

I. SUGARCANE IS A CRITICAL FEEDSTOCK TO ADVANCE CLEAN, RENEWABLE ENERGY USE

A. OVERVIEW OF SUGARCANE PRODUCTION

Sugarcane has been used as a feedstock for ethanol fuel production in Brazil for over a century.[5] In Brazil, the process of cultivating, harvesting, and processing sugarcane into ethanol

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[1] For additional information about UNICA, visit our website at http://english.unica.com.br, which contains up-to-date information, statistics, and technical briefings on the sugarcane industry in Brazil.

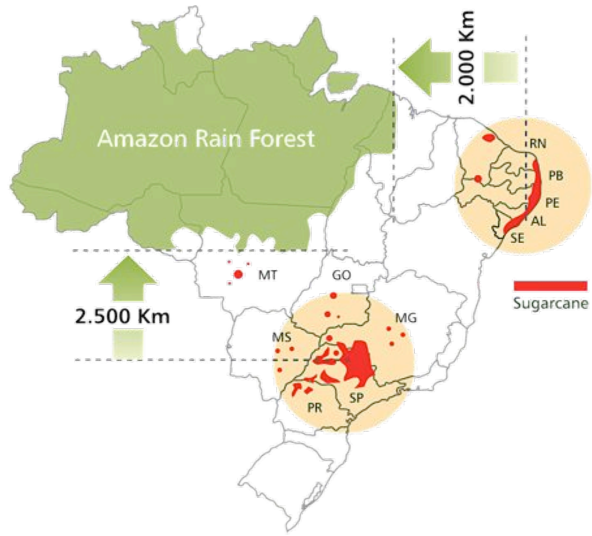
[2] We have made every effort to provide English-language references; however, given that significant research on sugarcane has been conducted in Brazil, we have relied on Portuguese literature when English version was not readily available. Wherever possible we have translated relevant documents and/or included web links for original publication. We are standing by to assist EPA in accessing the abundant literature in Portuguese.

[3] See page 30.

[4] See page 28.

[5] For a more detailed discussion of Brazil's experience with sugarcane ethanol as motor vehicle fuel, see "Comment submitted by Joel Velasco, Chief Representative, North America, and Alfred Szwarc, Emissions & Technology Advisor, of the Brazilian Sugarcane Industry Association (UNICA)," submitted to EPA in response to "Notice of Receipt of a Clean Air Act Waiver Application To Increase the Allowable Ethanol Content of Gasoline to 15 Percent," Document ID EPA-HQ-OAR-2009-0211-2580.1

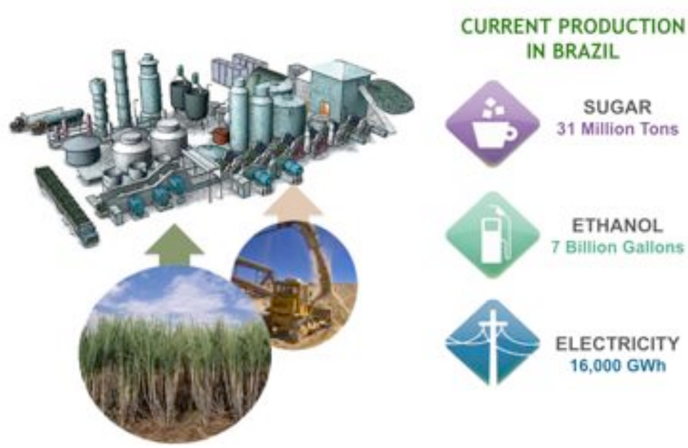
is relatively simple and straightforward, particularly when compared to the processes for starch-derived biofuels and the persistent challenges of cellulosic conversion noted in EPA's Draft Regulatory Impact Analysis (DRIA).[6]



Sugarcane is a semi-perennial crop that stores energy in the form of sucrose in its stalks. Once harvested, the cane stalks are grinded to extract the simple sugars, which are converted into a variety of products, most commonly fuel ethanol and raw sugar for human consumption.[7] The ethanol conversion process generally involves the use of yeast to digest the simple sugars into ethanol.[8]

Sugarcane is grown and processed into ethanol (and other products) in two main areas of Brazil, as the map above shows. The larger of these areas is the South-Central region of Brazil, which primarily includes the states of São Paulo, Paraná, Minas Gerais, Goiás, and Mato Grosso do Sul. Together this region represents about 90% of all sugarcane grown in Brazil today and where nearly all the expansion has taken place.[9] The second and smaller area where sugarcane is grown in Brazil is the Northeast coast, particularly in the states of Alagoas, Pernambuco, Paraíba, Sergipe and Ceará.

Sugarcane production in Brazil continues to increase not only due to heightened demand for fuel ethanol but also most recently due to growing global demand for raw sugar. In the 2008/09 crop year, Brazil harvested nearly 600 million metric tonnes of sugarcane which was used to produce over 31 million metric tonnes of sugar and about 7 billion gallons of ethanol (mostly hydrous for domestic consumption in flex-fuel vehicles). In the 2009/10 crop year, estimates from the Brazilian Ministry of Agriculture suggest that Brazil will harvest approximately 630 million metric tonnes of sugarcane, which will produce 37 million metric tonnes of sugar and 7.5 billion gallons of



[6] Brown, Robert C. *Biorenewable Resources: Engineering new products from agriculture*. Ames, Iowa: Iowa State, 2003.
[7] James, Glyn. *Sugarcane (World Agriculture Series)*. Grand Rapids: Blackwell Limited, 2003.
[8] See page 12-13 of Mastny, Lisa, ed. Biofuels for Transport Global Potential and Implications for Energy and Agriculture. Minneapolis: Earthscan Publications Ltd., 2007.
[9] Zuurbier, Peter, and Jos Van de Vooren, eds. *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment*. Wageningen, The Netherlands: Wageningen Academic, 2008

fuel ethanol.[10] Thus, the Brazilian sugarcane industry can help the world address both food and fuel needs simultaneously, without causing adverse environmental impacts to rainforests and other environmentally sensitive areas.

This year alone, Brazil's crop estimates show that while overall cane harvested volumes are expected to increase by about 10 percent, raw sugar production will increase by over 16 percent while fuel ethanol increases will be around 5 percent. This projection has been corroborated by UNICA's bimonthly crop update reports, which are available in English online.[11] As UNICA noted earlier this year in its own initial harvest estimate, the structural deficit in world sugar production, due to the shortcomings of other major sugar producing countries such as India, has had the effect of encouraging greater sugar – as opposed to ethanol – production in Brazil.[12] However, this effect may be short-lived due to the highly restricted world sugar market, which imposes extraordinary barriers to the free trade of sugar in the world.

Finally, as we demonstrate in greater detail in Section II below, sugarcane mills in Brazil generate their own power from the sugarcane biomass. Official government data indicates that sugarcane mills produced approximately 16,000 GWh of electricity, of which one third was surplus electricity that was fed into the Brazilian grid in 2008.[13] Industry estimates show this surplus cogeneration electricity, commonly known as "bioelectricity" in Brazil, will increase from 3% to 10% of Brazil's electricity demand by 2020 and will obviate the need to increase the number of fossil-based thermal power plants.[14]

B. SUGARCANE AS A RENEWABLE BIOMASS FEEDSTOCK

There is no dispute that Brazilian sugarcane meets the EISA's statutory definition of a renewable biomass feedstock,[15] as it is a "planted crop" that has been "harvested from agricultural land" that was under cultivation prior to December 2007 and remains "actively managed."[16] As the DRIA notes in Table 1.1-3, the planted sugarcane area in Brazil in the 2007 crop year was 19 million acres and overall agricultural land was 661 million hectares.

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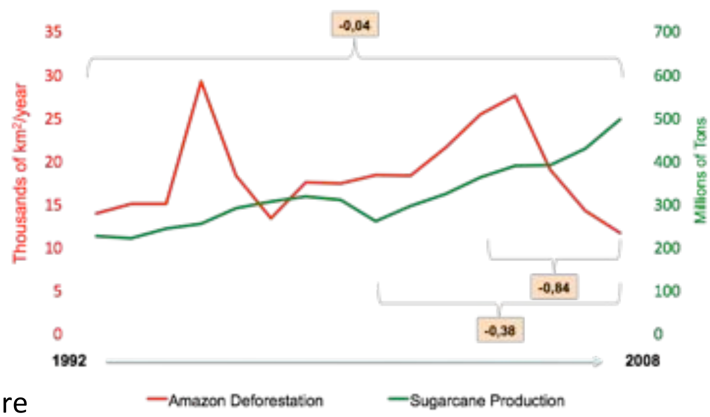
[10] See table on page 8 of CONAB crop harvest update, which is available in Portuguese from the Brazilian Ministry of Agriculture, Livestock and Supply. Brazil. Ministério da Agricultura Pecuária e Abastecimento (MAPA). CONAB - Companhia Nacional de Abastecimento. *Acompanhamento de Safra Brasileira: Cana-de-Açúcar, Segundo Levantamento.* MAPA, Sept. 2009. Web. Sept. 2009. <http://www.conab.gov.br/conabweb/>.
[11] See http://english.unica.com.br/releases/ (providing a crop update and statistical breakdown of all mills in South-Central Brazil, which represents 90% of country's sugarcane harvest).
[12] See http://www.unica.com.br/releases/show.asp?rlsCode={6B0A6260-026A-42FB-B4F1-ADE8CAA469F8}
[13] Patusco, Oao Antonio Moreira. "Balanço Energético Nacional – Ano Base 2008 – Dados preliminares – MME." 11 Aug. 2009. E-mail. 2008 data estimates provided by Brazilian Ministry of Mines & Energy (MME).
[14] Silvestrin, Carlos Roberto. "Bioeletricidade - Reduzindo Emissões e Agregando Valor ao Sistema Elétrico Nacional." *COGEN/SP*. Presentation made at Ethanol Summit in Sao Paulo, Brazil., 2 June 2009. Web. 1 Sept. 2009. <http://www.cogensp.com.br/workshop/2009/Bioeletricidade_Agregando_Valor_Matriz_Eletrica_03jun2009.pdf>.
[15] See EISA Title II, Subtitle A, Paragraph I and discussion in RFS2 Proposed Rule, page 24994 in 74 Fed. Reg. (May 26, 2009).
[16] See Companhia Nacional de Abastecimento (CONAB), Perfil do Setor do Acucar e do Alcool no Brasil, Situacao Observada em Novembro de 2007/Abril 2008. Ministério da Agricultura, Pecuária e Abastecimento. Brasilia: CONAB, 2008

Increased production of sugarcane is taking place in farming areas that do not displace native or forested vegetation.[17] While we discuss the land use dynamics in Brazil later on this document, it is important to note that scientific data shows that the overwhelming majority of sugarcane areas are located in land that has been converted to agriculture, not native forest.[18] For example, over 50% of the sugarcane production today is located within the southeastern state of São Paulo. An aerial survey of the Atlantic Forest indicated that forests covered about 14% of the state in 1962, over a decade before ethanol fuel became commonly used in Brazil.[19] In 2007, the most recent forestry inventory by the State of São Paulo Environmental Protection Agency shows that about 13.4% of the area is covered by native vegetation.[20] During that period, while total forested area remained stable, sugarcane planted area increased from about 286,713 hectares in 1962[21] to 4,249,922 hectares in 2007 in the state of São Paulo.[22]

More broadly, if we compare the total area used for sugarcane production to historical data of Amazon deforestation (*see chart on the right*), it is quite clear that there is no correlation between the deforestation — or in the words of former Vice President Al Gore, "thoughtless deforestation"[23] — and increased sugarcane production.[24] Nevertheless, the Brazilian sugarcane industry is committed to going one step further and, even before Brazilian President Luiz Inácio Lula da Silva proposed legislation[25] to establish an agro-ecological zoning for sugarcane, UNICA called for an outright prohibition in any future



[17] Nassar, Andre M., Bernardo Rudorff, Laura Barcellos Antoniazzi, Daniel Alves de Aguiar, Miriam Bacchi, and Marcos Adami. "Prospects of the Sugarcane Expansion in Brazil: Impacts on Direct and Indirect Land Use Changes." *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment*. Wageningen, The Netherlands: Wageningen Academic, 2008. 63-94.

[18] *O impacto do mercado mundial de biocombustíveis na expansão da agricultura brasileira e suas consequências para as mudanças climáticas*. WWF-Brasil, 29 Aug. 2009. Web. 10 Sept. 2009. <http://www.wwf.org.br/informacoes/bliblioteca/?21200/O-impacto-do-mercado-mundial-de-biocombustveis-na-expanso-da-agricultura-brasileira-e-suas-consequncias-para-as-mudanas-climticas>.

[19] See page 275. Dean, Warren. With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest (Centennial Book). New York: University of California, 1997.

[20] Secretaria do Meio Ambiente de São Paulo. Instituto Florestal do Estado de Sao Paulo. Inventário Florestal da Vegetacão Natural do Estado de São Paulo. Sao Paulo, SP: SMA Governo Estadual de São Paulo, 2007.

[21] IAE

[22] "Área de Cana Safra e Reforma na Região Centro-Sul." *CANASAT*. Instituto Nacional de Pesquisas Espaciais (INPE), Divisão de Sensoriamento Remoto (DSR). Web. 1 Aug. 2009. <http://www.dsr.inpe.br/canasat/tabelas.jsp>.

[23] See http://www.c-spanarchives.org/library/includes/templates/library/flash_popup.php?pID=283696-1&searchphrase=thoughtless.

[24] Amazon deforestation data provided by Brazilian Space Agency (INPE). Deforestation data is calendar year while sugarcane production is based on crop years.

[25] For full text of proposed legislation (*in Portuguese only)* see http://www.planalto.gov.br/ccivil_03/Projetos/PL/2009/msg764-090917.htm. Supporting documentation is available at http://www.planalto.gov.br/ccivil_03/Projetos/EXPMOTIV/EMI/2009/24%20-%20MAPA%20MMA%20MME%20MF%20MDA.htm

sugarcane production in sensitive ecosystems such as the Amazon rainforest.[26] Specifically, President Lula's proposed legislation would "prohibit the construction or expansion of sugarcane farms and production plants in any area of native vegetation, or in the Amazon, Pantanal (Brazilian Wetlands) or Upper Paraguay River Basin regions. Coupled with the areas not suitable for sugarcane farming, the bill would effectively make 92.5% of Brazil's national territory off-limits for sugarcane farming and processing."[27] Conversely, nearly 65 million hectares (7.5% of Brazil's territory) could be used for sugarcane. Moreover, UNICA has led in the creation of the Brazilian Climate Alliance, which advocates binding commitments to curtail deforestation and meaningful targets for GHG emission reduction.[28]

C. CONVENTIONAL BENEFITS OF SUGARCANE AS A RENEWABLE FEEDSTOCK

Brazil's abundant rainfall and warm weather have made sugarcane an ideal renewable feedstock for ethanol production.[29] With an average annual yield during a five-year cycle of 85 metric tonnes of sugarcane per hectare (34.5 metric tonnes per acre) and an average ethanol production of 85 liters (22.5 gallons) of ethanol produced from each ton of sugarcane, Brazilian sugarcane mills have an average ethanol production of 7,225 liters per hectare (765 gallons per acre). This high yield has been growing steadily, particularly in South-Central Brazil where agricultural practices have been evolving quite quickly.[30] In addition to high farm yields, another benefit of sugarcane is a renewable feedstock with a strong energy balance. Currently sugarcane ethanol produced in Brazil yields 9.3 units of renewable energy for each unit of fossil fuel used in its production. According to the latest research, this production may reach 11.6 units of renewable energy for each unit of fossil fuel by 2020 through the use of existing commercial technologies in Brazil, including the increased use of sugarcane bagasse for cogeneration.[31] (Bagasse is the main byproduct from the processing of sugarcane that is high in cellulosic fiber and moisture content. Bagasse's use and benefits are discussed in more detail in Section III.)

Also, while there has been a greater than eight percent increase in Brazilian sugarcane yields observed in this decade so far, the physical yield of the sugarcane *plant* is not the only source of yield gains in the production of sugarcane ethanol. [32] The yield gain in Total Recoverable Sugars

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[26] See government announcement at http://www.cnps.embrapa.br/noticias/banco_noticias/20090917.html and UNICA's comments at http://english.unica.com.br/releases/show.asp?rlsCode={6FF09728-9C40-4291-B419-47050EA5545F}

[27] Brazil. Presidency of the Republic. Secretariat of Communications (SECOM). *Brazil Increases Environmental Preservation Measures With Sugarcane Zoning Proposal*. PR Newswire, 17 Sept. 2009. Web. 17 Sept. 2009. <http://sev.prnewswire.com/agriculture/20090917/SPTH00117092009-1.html>.

[28] See announcement and position paper of the Brazilian Climate Alliance available at http://english.unica.com.br/noticias/show.asp?nwsCode=5E846923-01FA-4099-B54E-D969BC3756A3

[29] Sandalow, David. "Ethanol: Lessons from Brazil." *High Growth Strategy for Ethanol: The Report of an Aspen Institute Policy Dialogue*. Washington, DC: Aspen Institute, 2006. 67-74.

[30] Macedo, Isaias C. "The sugarcane Agro-industry: Its contribution to reducing CO_2 emissions in Brazil." Biomass and Bioenergy 3.2 (1992): 77-80

[31] Macedo, Isaias C., Joaquim Seabra, and Joao Silva. "Greenhouse gases emissions in the production and use of ethanol from sugarcane in Brazil: The 2005/2006 averages and a prediction for 2020." Biomass and Bioenergy 32.7 (2008): 582-95.

[32] See table 5 of the following study: Ministério da Agricultura, Pecuária e Abastecimento. 2007. Balanço Nacional da Cana-de-Açúcar e Agroenergia. Edição Especial de Lançamento. Available at

(TRS) should also be considered as that is the target for sugarcane farming. TRS is a measure of the energy content (in sugars, excluding lignocellulosic biomass) of the sugarcane.[33] According to the Ministry of Agriculture, Livestock and Supply (2007)[34], the TRS per ton of sugarcane was 138.7 in 2001 and 149.47 in 2006 — an increase of 8.3 percent. (We note that this result would be even higher if official data for 2007 and 2008 were already available.) Higher TRS are obtained over time due to different improvements in sugarcane production, such as better varieties and harvesting period. In short, when looking at yields, EPA should carefully consider TRS yield (kilograms of sugars per ton of crop) increases as well as traditional yield measures (metric tonnes of crops per acre). Most worrisome, the FAPRI model appears to ignore this essential aspect of sugarcane.

D. GREENHOUSE GAS REDUTION OF SUGARCANE AS A RENEWABLE FEEDSTOCK

Sugarcane ethanol is, by far, the world's most efficient biofuel produced at a commercial scale. The greatest benefit, however, of sugarcane as a feedstock for biofuels production is the ability to reduce GHG emissions when compared to fossil fuels.[35] Traditional lifecycle analysis has shown that sugarcane ethanol, as currently produced in Brazil, reduces GHG emissions by up to 90% when compared to traditional gasoline.[36] In addition, with productivity and efficiency gains in sugarcane production further reduction in emissions will only improve sugarcane ethanol's GHG profile, likely turning carbon negative when considering its byproducts.

Several additional factors explain why sugarcane ethanol can reduce GHG emissions. First, sugarcane absorbs 22-36 metric tonnes of CO_2 per hectare per year.[37] Second, emissions from land use are minimized as the crop is replanted every six years on average, reducing the release of CO_2 following tillage. Because harvesting sugarcane — whether manually or mechanically — does not destroy its complex root system, a new stalk will grow and be harvested for five to seven years before its yields (measured as Total Recoverable Sugars, TRS, as noted earlier) drop and a new planting is made.[38] Third, the use of byproducts such as vinasse, a nutrient rich

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www.feagri.unicamp.br/energia/bal_nac_cana_agroenergia_2007.pdf. (We note that this result would be even higher if official data for 2007 and 2008 were available at this time.)

[33] Technical explanation about TRS can be obtained in the following publication: Macedo, I. C (organizer). 2007. Sugar Cane's Energy: Twelve Studies on Brazilian Sugar Cane Agribusiness and its Sustainability. Berlendis & Vertecchia and UNICA – União da Agroindústria Canavieira do Estado de São Paulo. São Paulo (available at http://english.unica.com.br/multimedia/publicacao/). See also SEABRA, J. E. A. Análise de opções tecnológicas para uso integral da biomassa no setor de cana de-açúcar e suas implicações. Campinas: Universidade Estadual de Campinas, Faculdade de Engenharia Mecânica, 2008.

[34] See table 5 of the following study: Ministério da Agricultura, Pecuária e Abastecimento. 2007. Balanço Nacional da Cana-de-Açúcar e Agroenergia. Edição Especial de Lançamento (available at www.feagri.unicamp.br/energia/bal_nac_cana_agroenergia_2007.pdf).

[35] Wang, Michael, and May Wu. "Life-cycle energy use and greenhouse gas emission implications of Brazilian sugarcane ethanol simulated with the GREET model." International Sugar Journal 110.1317 (2008): 527-45.

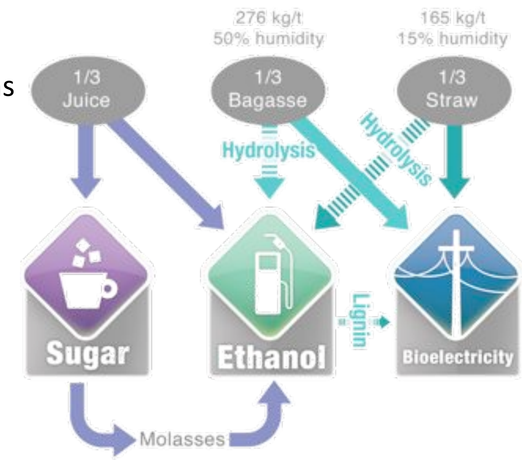
[36] Zuurbier, Peter, and Jos Van de Vooren, eds. Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment. Wageningen, The Netherlands: Wageningen Academic, 2008.

[37] 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. Wageningen, The Netherlands: Wageningen Academic, 2008. Also see Beeharry, Revin Panray. "Carbon balance of sugarcane bioenergy systems." *Biomass and Bioenergy* 20.5 (May 2001): 361-70.

[38] See pages 162-163 of Bakker, H. Sugar Cane Cultivation and Management. New York: Springer, 1999.

liquid resulting from sugarcane ethanol distillation, and other organic pest management techniques are used to offset carbon intensive agricultural inputs.[39]

Of note, a recently published peer-reviewed article shows that the use of sugarcane ethanol in Brazil as a transportation fuel since 1975 has led to a reduction of CO_2 emissions of about 600 million tons, even including estimates for past land use changes. If the use of the bagasse for electricity cogeneration and other efficiency gains had been implemented earlier, the net avoided emissions would increase to over 1 billion tons of CO_2 from 1975 to 2007. Going forward the paper predicts that, based on a reasonable growth rate of 4.3% per year, sugarcane in Brazil would mitigate 836 tons of CO_2 annually in twenty years, or over 10 billion tons of CO_2 in the period.[40]



The future of this renewable feedstock is bright indeed. However, considering that 1 metric ton of sugarcane has the same energy content as 1.2 barrels of oil, there is much more renewable energy to capture from sugarcane.[41] As the chart on the right indicates, the sugarcane juice — the simple sugars that are used to produce sugar and ethanol — represent only one-third of the plant's energy value. The remaining two-thirds is bagasse (the fiber residues remaining after sugarcane processing) and foliage (also referred to as straw or trash) that until recently was burned prior to harvest.

Until a few years ago, sugarcane mills used the sugarcane bagasse to generate vapor and produce electricity for their own consumption. But now, as a result of a number of changes that we detail in Section IV below, mills are generating surplus electricity, which is fed into the grid, substituting other forms of carbon-intense electricity such as those from thermoelectric plants. Through progress in mechanized harvesting and the phase out of open-air burning, estimates are that about 40% of sugarcane straw will be used to generate bioelectricity in the near future. (Cellulosic biofuels, in our experience, are not yet commercially available and would have to be competitive with electricity.) Together with new investments in transmission grids and high-pressure boilers, the bioelectricity potential of the sugarcane sector will increase considerably and is expected to supply over 10% (up from 3% today) of the Brazil's electricity consumption by 2020. Without this renewable energy supply, Brazil would have had to build thermal power plants running on fossil fuels as the country has nearly exhausted its hydroelectric potential.[42]

[39] *Sustainability Report.* Tech. Sao Paulo, Brazil: UNICA, 2008. This report met the requirements of the Global Reporting Initiative (GRI) and is available online at http://www.unica.com.br/download.asp?mmdCode={D1814075-0E5C-4BFB-BA2C-EF428FF58F33}

[40] Pacca, Sergio, and Jose Roberto Moreira. "Historical Carbon Budget of the Brazilian Ethanol Program." Energy Policy (2009). Article in Press (Corrected Proof Available Online).

[41] Goldemberg, Jose. "The Brazilian Biofuels Industry." *Biotechnology for Biofuels* 1.6 (2008).

[42] McNish, Tyler, Arne Jacobson, Dan Kammen, Anand Gopal, and Ranjit Deshmukh. "Sweet carbon: An Analysis of Sugar Industry Carbon Market Opportunities under the Clean Development Mechanism." *Energy Policy* (2009).

E. CRITICISM OF ADVERSE IMPACTS ARE MERITLESS

There are various myths related to sugarcane ethanol that require rebuttal with facts. The first major myth is that sugarcane ethanol is causing the deforestation of the Amazon Rainforest.[43] As noted above, 90% sugarcane for ethanol production is harvested in South-Central Brazil — about 1,600 miles from the Amazon. The remaining 10% is grown in Northeastern Brazil — about the same distance from the Amazon's easternmost fringe. That is roughly the distance between New York City and Dallas, or between Paris and Moscow.[44]

The second myth is that increased sugarcane production displaces other agricultural activities that in turn move into the rainforest. This too is not accurate. According to the Brazilian National Institute for Spatial Research (INPE), about 65% of recent sugarcane expansion took place on pastures, mostly degraded, in South-Central Brazil. As such, growing sugarcane in these areas does not increase competition for new land or displace other crops, instead leading to cattle intensification (as discussed in Section III.B.) Amazon deforestation, which has been going on for many decades, has been caused by an unfortunate and complex set of social and economic factors completely unrelated to the expansion of Brazil's sugarcane industry.[45] One of the main issues is the absence of clear land titles that leaves the region exposed to rampant land speculation and squatting. Forty-three percent of the Amazon is officially protected, while the rest is divided between areas that are supposed to be public (21%) and private (32%). But the truth is that only 4% of the private areas have legal titles.[46] As a result of the lack of clear property rights and enforcement of the law, illegal logging is the "cash crop" of the rainforest. Finally, over 20 million people currently live in the Amazon region. Tragically, to many of them, the standing forest has no value for their immediate well-being, or economic survival.[47]

The third myth is that Brazil is overrun by sugarcane plantations to the detriment of food production and food prices. As the DRIA correctly notes, in 2007 sugarcane for ethanol production in Brazil occupied 3.4 million hectares, or roughly one percent of the country's 355 million hectares of arable farmland. The area cultivated for sugarcane and used for ethanol is less than one-fourth of Brazil's corn acreage, one-eighth of soybean fields, and one-sixtieth of the land used for cattle ranching. With only 1 percent of its arable land dedicated to sugarcane for ethanol production, Brazil has been able to replace half of its gasoline needs with sugarcane ethanol. In additional, while cane production has increased steadily in recent years, food production in Brazil has grown dramatically. The 2007 harvest for grain and oilseed set a record

[43] Goettemoeller, Jeffrey, and Adrian Goettemoeller. *Sustainable Ethanol Biofuels, Biorefineries, Cellulosic Biomass, Flex-fuel Vehicles, and Sustainable Farming for Energy Independence*. Grand Rapids: Prairie Oak, 2007.

[44] It is true that there is a very small amount of sugarcane production in the Amazon, but it is less than 0.2% of Brazil's total production. It is processed at three mills that were built more than twenty years ago at a time when the government provided fiscal incentives to set up industrial facilities in the Amazon to supply mostly sugar, not ethanol, in the local market. Without subsidies, these mills would not have been economically viable because the Amazon region does not offer favorable conditions for commercial sugarcane production.

[45] Margulis, Sérgio. *Causes of Deforestation of the Brazilian Amazon*. Washington, DC: World Bank, 2004.

[46] Barreto, P., A. Pinto, B. Brito, and S. Hayashi. *Quem é Dono da Amazônia: Uma análise do recadastramento de imóveis rurais*. Belem, PA Brazil: Imazon, 2008. Web. 1 Sept. 2009. <http://www.imazon.org.br/publicacoes/publicacao.asp?id=537>.

[47] For a more recent discussion of the dynamics of Amazon deforestation, see Mark London's *The Last Forest: The Amazon in the Age of Globalization*. New York: Random House, 2007

at 142 million metric tonnes, twice that of ten years ago. Brazil is widely recognized for its diversified and highly efficient agricultural sector – it is the world's leading exporter of beef, coffee, orange juice, poultry, soybeans and sugar, just to name a few of the top commodities. Just this year, despite a booming demand for ethanol in Brazil, sugarcane mills have increased sugar production by 20 percent in response to a global shortfall drive in large part due to a sugar production shortfall in India.

The fourth myth is that ethanol production and use cause more damage to the environment than fossil fuels. Of course, ethanol can be produced from a wide variety of feedstocks, with different environmental impacts depending on how they are processed. Claims that sugarcane ethanol production could actually increases carbon emissions are flawed. Brazilian ethanol produced from sugarcane reduces greenhouse gas emissions by up to 90% compared to gasoline, a reduction unmatched by any other biofuel produced with existing technology and comparable to what is attained with second-generation biofuels. This positive balance is only marginally affected by changes in land use as described later in this document. In fact, when compared to crops such as corn or soybeans, sugarcane captures more carbon because it is a unique semi-perennial crop only replanted every six years. In addition, the use of degraded pastures – the expansion area of choice for sugarcane in Brazil – actually generates a carbon credit, as sugarcane captures significantly larger amounts of carbon than the quantities originally stocked in this type of land. As noted above, the by-products of sugarcane ethanol production (bagasse and in the future straw) are used to produce clean, renewable electricity, currently accounting for 3% of Brazil's electricity needs and expected to surpass 10% by 2015.

II. <u>EPA SHOULD FINALIZE THE RFS2 AT THE EARLIEST OPPORTUNITY</u>

We strongly urge EPA to complete the RFS2 rulemaking at the earliest opportunity, specifically so that the RFS2 mandate may be implemented starting on January 1, 2010. The deadline by which Congress ordered EPA to revise the RFS regulations already has passed. *See* 42 U.S.C. § 7545(o)(2)(A)(i) ("Not later than 1 year after December 19, 2007, the Administrator *shall* revise the regulations . . . .") (emphasis added). Any further delay would undermine public support for the program, negatively impact the investments in the renewable fuel industry globally, and likely exacerbate the detrimental impacts of continued dependency on fossil fuels for transportation fuels in the United States and abroad. While we have some specific concerns that we believe should be addressed in the final rule, it is imperative that EPA avoid any further delays. Further, the thoroughness of the analysis and conclusions in the proposed rule demonstrate the extent to which the RFS2 can be finalized without delay. As described below, EPA correctly has made significant decisions supported by a strong rationale in the proposed rule, which can facilitate a timely finalizing of the rule.

A. EPA HAS A MANDATORY DUTY TO FINALIZE THE RFS2 TO IMPLEMENT THE EISA

Various groups critical of the nation's renewable fuel goals, including those goals Congress directly addressed in the EISA itself, undoubtedly will urge EPA to delay final promulgation of the RFS2 rule. UNICA, however, believes that EPA must ignore those requests and comply with the nondiscretionary mandate specified in the EISA.

UNICA was one of the few, if not the only, organization that asked that EPA not extend the comment period for the RFS2 Proposed Rule.[48] As we noted in our June 23, 2009 letter, the extension of the comment period makes "it more difficult for EPA to begin implementing the RFS2 regulatory program on January 1, 2010, as proposed. The program, which is mandated under the 2007 Energy Independence and Security Act, will help the United States increase its use of renewable fuels and, in turn, reduce its dependence on foreign oil and lower GHG emissions."[49]

Despite the extension of the comment period, EPA has indicated that it seeks to finalize the RFS rule by the end of this year. EPA states that "due to the addition of complex lifecycle assessments to the determination of eligibility of renewable fuels, the extensive analysis of impacts that we are conducting for the higher renewable fuel volumes, the various complex changes to the regulatory program that require close collaboration with stakeholders, and various statutory limitations […] we are proposing that the RFS2 regulatory program go into effect on January 1, 2010."[50] We believe that EPA has a mandatory, non-discretionary duty to finalize the RFS2 this year in order to implement the EISA requirements, which were enacted into law nearly *two* years ago and require EPA to revise the RFS regulations by December 19, 2008. EPA admits as much in the notice of Proposed Rulemaking, which states "under the [Clean Air Act] section 211(o) as modified by EISA, EPA is *required* to revise the RFS1 regulations within one year of enactment, or December 19, 2008." 74 Fed. Reg. at 24913 (emphasis added.)

Indeed, EPA was under a mandatory, non-discretionary duty to revise the RFS regulations by December 19, 2008. *See Natural Resources Defense Council, Inc. v. EPA*, 797 F. Supp. 194, 196 (E.D. N.Y. 1992) (stating that it is "clear and undisputed" that EPA violated a statutory mandate when it failed to publish a guidance that the Clean Air Act required be published "[w]ithin 12 months" and that the Court has the "equitable power to impose a deadline on EPA"); *cf. also Norton v. Southern Utah Wilderness Alliance*, 542 U.S. 55, 64 (2004) (citing 5 U.S.C. § 706(1) (When "an agency fail[s] to take a discrete agency action that it is *required* to take," the Administrative Procedure Act authorizes courts to compel agency action when it is "unreasonably delayed."); *American Canoe Ass'n, Inc. v. EPA*, 30 F. Supp. 2d 908. 921 (E.D. Va.

[48] See "Comment submitted by Joel Velasco, Chief Representative, North America, and Alfred Szwarc, Emissions & Technology Advisor, of the Brazilian Sugarcane Industry Association (UNICA)," submitted to EPA in response to "Notice of Receipt of a Clean Air Act Waiver Application To Increase the Allowable Ethanol Content of Gasoline to 15 Percent," Document ID EPA-HQ-OAR-2009-0211-2580.1
[49] Available online at http://www.whitehouse.gov/the_press_office/President-Obama-Announces-Steps-to-Support-Sustainable-Energy-Options/
[50] See 74 Fed. Reg. at 24913.

1998) (Clean Water Act's deadline for EPA to approve or disapprove of state's total maximum daily loads and total maximum daily thermal loads of pollutants was "readily-ascertainable" and imposed a mandatory, nondiscretionary duty on EPA, enforceable through a CWA citizen suit).

The agency's new plan to implement the regulations by January 1, 2010, is thus already well past its statutory deadline. Any further delay would be unreasonable and, therefore, a court could compel EPA to act. "When EPA has failed to discharge a nondiscretionary duty under the Clean Air Act, a district court has jurisdiction to compel the Administrator to fulfill it." *Sierra Club v. Johnson*, 444 F. Supp. 2d 46, 52 (D.D.C. 2006) (citations omitted). While a court may under extraordinary circumstances not presented here extend a Congressionally-mandated time limit, it will only do so when it is impossible or infeasible for EPA to meet the deadline. *Id.* at 52-53; *Natural Resources Defense Council*, 797 F. Supp. at 196-97. Here, EPA is already proposing to revise the regulations a full year after the statutory deadline. Given the great importance of finalizing the RFS2 rule and the delay that has already occurred, the agency cannot meet the "especially heavy" burden that would be required to show it is impossible to finalize the rule by the end of the calendar year and justify additional delay. *Natural Resources Defense Council*, 797 F. Supp. at 197.

In short, we believe it is not only "necessary" but also "required" that EPA implement the RFS2 rule by January 1, 2010. We therefore urge EPA to reject the requests it likely will receive to delay this rule further past its statutory deadline.

B. THE PROPOSED RULE THOROUGHLY CONSIDERED AND EVALUATED RELEVANT ISSUES

As UNICA noted during our participation in the EPA-organized workshop on June 9, 2009, as well as in various other public forums, we believe EPA staff deserves recognition for "its trailblazing work in this Proposed Rule, which took too long to be released for public comment — not the fault of the EPA staff but of some special interests who preferred uncertainty and delays over peer-reviews and technological progress."[51] While we believe EPA could continue to strengthen the Proposed Rule is several ways — as indicated in these comments as well as comments from other stakeholders — the proposed text indicates clearly that EPA staff thoroughly considered and evaluated major, relevant issues involved.

EPA has proposed to resolve numerous core issues in a reasonable manner and based on the support of an extraordinarily strong and significant record. Specifically, we believe EPA is well prepared to finalize the RFS2 in a defensible posture in a manner that promotes Congress' intent by deciding the following issues:

- Affirming in the final rule that sugarcane qualifies as an advanced biofuel, either under a revised 40 percent threshold for advanced biofuels or through a more

[51] Remarks at EPA's Renewable Fuel Standard's Public Hearing, EPA/OTAQ Cong. (2009) (testimony of Joel Velasco, Chief Representative, Brazilian Sugarcane Industry Association (UNICA)), June 9, 2009. See Document ID: EPA-HQ-OAR-2005-0161-1017.

accurate lifecycle assessment of sugarcane derived ethanol that accurately establishes the greenhouse gas reductions of sugarcane at more than 50 percent;

- Waiving the cellulosic biofuel requirements at this time to allow advanced biofuels to satisfy the cellulosic mandates;
- Properly weighting different advanced biofuels based on their actual greenhouse gas reduction benefits to further EPA's goals of addressing climate change as expressed in EPA's proposed endangerment finding;
- Affirming that lifecycle analysis should apply fairly across the board to all feedstocks, regardless of whether they originate domestically or internationally; and
- Implementing key components of the RFS2 by the January 1, 2010 deadline, including the affirmance that sugarcane derived biofuels qualify as advanced biofuels.

C. EPA SHOULD ADJUST ADVANCED FUEL LIFECYCLE THRESHOLD TO 40% IN FINAL RULE

EPA requested comments on whether it should adjust the GHG threshold for advanced biofuels "to as low as 40%." While UNICA believes that there is abundant scientific evidence that sugarcane ethanol reduces GHG emissions compared to conventional gasoline by up to 90%, we concur that the threshold should be set at 40% at this time. We base this position on a reasonable interpretation of the EISA as well as on the considerable uncertainties generated by the complex modeling adopted by EPA.

As is clearly stated in the EISA,[52] the Administrator may adjust the 50% threshold for Advanced Biofuels if it is determined "that generally such reduction is not commercially feasible for fuels made using a variety of feedstocks, technologies, and processes to meet the applicable reduction" of 50%. As noted both in the Proposed Rule and the DRIA, other than sugarcane ethanol from Brazil, there is no "renewable fuels that may be available in sufficient volumes over the next several years to allow the statutory volume requirements for advanced biofuels to be met." [53] EPA's lifecycle analysis in the proposed rule "suggests that sugarcane based ethanol only offers an estimated 44% reduction in GHG emissions relative to the gasoline it replaces when assessing 100 years of emission impacts and discounting these emissions 2%, and an estimated 27% reduction when assessing 30 years of emission impacts with no discounting."[54] Therefore, if EPA did not update the lifecycle analysis in the Final Rule, which we urge that it do, sugarcane ethanol would not qualify as an advanced biofuel at the 50% GHG threshold. We believe this result would be unreasonable given the uncertainty in EPA's lifecycle analysis and the clear Congressional intent to include sugarcane ethanol as an eligible advanced biofuel and the clear direction to lower the threshold under the circumstances presented here.

[52] See Title II, Subtitle A, Section 202,(c)(4).
[53] See 74 Fed. Reg. at 25049; DRIA at page 408.
[54] 74 Fed. Reg. at 25049

The DRIA and Proposed Rule, as well as EPA's public presentations, have made clear that EPA's lifecycle analysis contains "varying degrees of uncertainty."[55] Moreover, while Congress expressly excluded "corn starch" from the fuels eligible for consideration as an advanced biofuel category, it explicitly included "ethanol derived from sugar."[56] Given the evolving nature of the relevant science and the clarity of the congressional intent to include sugarcane ethanol among the eligible advanced biofuels, a threshold of 40% "would help ensure that the volume mandate for advanced biofuel" is met.[57]

Thus, in order to realize the goals of the EISA and Congress' direction, EPA should lower the threshold to 40 percent. Failing to do so, without reassessing the appropriate reduction for sugarcane ethanol, would result in a rule that fails to achieve *any* goals set out for advanced biofuels. In the alternative, should EPA reconsider the reduction for sugarcane based ethanol and assess the reduction as it should at above 50 percent, the need to lower the threshold is mitigated. As described above, it is our firm belief that sugarcane ethanol actually offers a much greater reduction in GHG emissions than reflected in EPA's proposed rule. In fact, the abundance of academic research – described in these comments and by other stakeholders – shows that sugarcane ethanol will reduce GHG emissions by up to 90% when compared with traditional gasoline. Such a reduction is much higher than the 50% threshold target necessary to qualify it as an advanced biofuel. Therefore EPA must permit Brazilian sugarcane ethanol to be characterized as an advanced biofuel, whether at a reduction level above 50 percent or by lowering the threshold as intended by Congress to 40 percent.

Finally, further emphasizing the need to properly characterize sugarcane as an advanced biofuel is EPA's own reasonable conclusion that any "advanced biofuel produced above and beyond what is required for the advanced biofuel requirements could reduce the amount of corn ethanol needed to meet the total renewable fuel standard."[58] We fully support this conclusion, which is well supported by the record. On its face, the EISA does not specify any amount of "corn-ethanol" volume that must contribute to the total renewable fuel standard. In addition, allowing advanced biofuels to be used beyond what is required to meet the advanced biofuel requirements will help promote a primary goal of the RFS2 – it will encourage the use of the lowest GHG emitting renewable fuels.

D. WAIVER FOR CELLULOSIC BIOFUELS

As required by EISA, the RFS2 Proposed Rule categorizes renewable fuels based on the results of the lifecycle analyses and addresses possible waivers for cellulosic biofuels. There has been ample discussion in public forums about the likelihood that there will not be enough cellulosic biofuels available to meet the RFS2 volume targets for 2010 and beyond.[59]

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[55] See 74 Fed. Reg. at 25020.
[56] See EISA Title II, Subtitle A, Section 1(B)(ii)(II).
[57] See 74 Fed. Reg. at 24912.
[58] DRIA at page 67
[59] Davis, Ann, and Russell Gold. "Turmoil in Biofuels Threatens Green Energy Revolution; Capacity sits idle amid falling oil prices, recession and delays of government rules." *The Wall Street Journal* [New York, NY] 28 Aug. 2009: 14.

UNICA concurs with EPA's interpretation of the EISA that "it would be appropriate to allow excess advanced biofuels to make up some or all of the shortfall in cellulosic biofuel."[60] Clearly congressional intent in creating the *advanced* biofuel was to encourage innovation in biofuel technologies that would reduce GHG emissions as compared to the gasoline baseline. Indeed, the stated purposes of the EISA include "increas[ing] the production of clean renewable fuels." *See also* 74 Fed. Reg. at 25021 (explaining that the rule's requirements "are designed to ensure significant GHG emission reductions from the use of renewable fuels and encourage the use of GHG-reducing renewable fuels."). Also, President Obama has called on EPA to increase renewable fuels in order to reduce dependence of foreign oil and reduce greenhouse gas emissions.[61] Therefore, even if the pathways that yield the greatest GHG emission reductions are not "cellulosic" per se, EPA should encourage their use to help meet the RFS2 mandate.

In any given year, if there is an insufficient volume of cellulosic biofuel available but an ample volume of other advanced biofuels available with *GHG emissions equal or better than the cellulosic threshold*, EPA should not lower the required volumes for advanced biofuel but instead shift the requirement from cellulosic to the other advanced biofuel categories. To ignore this option would be to encourage the use of fossil fuels – the very opposite result to congressional intent. In a similar vein, we strongly concur with EPA's assertion that "we do not believe it would be appropriate to lower the advanced biofuel standard but not the total renewable standard, as this would allow conventional biofuels to effectively be used to meet the standards that Congress specifically set for cellulosic and advanced biofuels." [62]

E. PROMOTING LOW CARBON FUELS TO ADDRESS GHG ENDANGERMENT FINDING

EPA has discretion to adjust the required volumes under the RFS2 in favor of lower GHG emission renewable fuels. By exercising this discretion, EPA will establish a program that will help the agency meet other near and long-term goals.

EPA recently proposed findings that GHG emissions from motor vehicles "cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare" under the Clean Air Act.[63] *See* Notice of Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Proposed Rule, 74 Fed. Reg. 18886 (April 24, 2009).

Once an endangerment finding is made, EPA must seek to reduce the GHG emissions from motor vehicles and the fuels they consume. In the absence of cellulosic biofuels that reduce GHG by 60% compared with baseline gasoline, EPA would be required to consider whether

[60] See 74 Fed. Reg. at 24914.
[61] See The White House Office of the Press Secretary, President Obama Announces Steps to Support Sustainable Energy Options, Departments of Agriculture and Energy, Environmental Protection Agency to Lead Efforts (May 5, 2009). , http://www.whitehouse.gov/the_press_office/President-Obama-Announces-Steps-to-Support-Sustainable-Energy-Options/>
[62] 74 Fed. Reg at 24915.
[63] See http://epa.gov/climatechange/endangerment.html

there are other renewable fuels that could reduce GHG by the same *or greater* levels. EPA would also have to consider that, in the absence of an advanced biofuel, greater volume of gasoline would be consumed, generating additional harmful GHG emissions.

We urge the agency not to wait for a final endangerment finding to promote the use of the lowest GHG emitting renewable fuels. We recommend that EPA establish in the final RFS2 rule that the best performing renewable fuel pathway in any given RFS2 category would receive commensurately higher equivalence values based on their relative reduction in greenhouse gas emissions (Code "RR" in 38-digit Renewable Identification Numbers, RIN, codes). In the absence of such a requirement, the renewable fuel with the lowest price — not necessarily the fuel with the lowest GHG emissions — would be consumed in the greatest quantity. In contrast, by including such a requirement, there would likely be greater demand for the fuels with lower GHG emissions as compared to conventional renewable fuels, which in turn would help address the concerns raised in the proposed endangerment finding.

By including such a proportionate mechanism in the Final Rule, EPA would promote the highest density, lowest carbon biofuels in a technology-neutral manner, encourage the use of renewable fuels that are fungible within the existing hydrocarbon fuel infrastructure, and mitigate against climate change.

F. INTERNATIONAL VS. DOMESTIC INDIRECT LAND USE

EPA should apply the same standard for assessing international land use change to both domestic and internationally sourced feedstocks.[64] During the comment period, some members of Congress introduced legislation that would exclude the "international" component of "land use change" emissions calculations in the RFS2.[65] Under the House-approved climate legislation (HR 2454), an amendment was added to direct the Administrator to exclude from the RFS2 "emissions from indirect land use changes outside the renewable fuel's feedstock's country of origin."[66] In the Senate, some Senators are seeking to amend the appropriations bill that authorizes EPA funding to prohibit the EPA from including "international" indirect effects from the RFS2 lifecycle calculations.[67]

Putting aside the technical impossibilities of such requirement, we strenuously caution EPA against applying different standards for calculating emissions for domestically vs. foreign produced fuels. Such an approach would undercut EPA's ability to establish the 2010 RFS2 (see below), increase fuels market uncertainty at a time of economic stress, and likely undermine the ongoing work of EPA and stakeholders aimed at reducing the level of uncertainty associated with these calculations and models.

[64] See 74 Fed. Reg. at 25020.
[65] See press conference by House Speaker Nancy Pelosi and House Agriculture Chairman Collin Peterson on June 24th. For details and criticism of the proposal, see http://switchboard.nrdc.org/blogs/ngreene/deal_in_the_house_moves_climat.html
[66] See HR 2454, Title 5, Subtitle C, Section 551.
[67] Reeves, Dawn. "EPA Fights Budget Rider Banning Biofuels Indirect Lifecycle GHG Assessment." *InsideEPA*. Inside Washington Publishers, 22 Sept. 2009. Web. 22 Sept. 2009. <http://www.insideepa.com/secure/docnum.asp?docnum=9212009_harkin>.

G. RENEWABLE FUEL STANDARD FOR 2010

EPA needs to finalize the RFS2 at the earliest opportunity to implement the program by January 1, 2010. Given the thoroughness of the proposed rule and EPA's work to date, we believe EPA is well positioned to meet this deadline. However, should this already-extended deadline not be fully met, we urge EPA to implement an in interim RFS2 based on the best available information before the Agency.

We strenuously caution against only increasing the conventional biofuel mandate and presuming that all biofuels will be counted in the conventional pool. Congressional intent was clear – to encourage the use of progressively cleaner, renewable fuels. President Obama reaffirmed as much at the launch of the Biofuels Interagency Working Group earlier this year.[68] In short, EPA has an abundance of information to make a determination that sugarcane ethanol meets the advanced biofuels lifecycle threshold and should implements the RFS2 without delay in 2010 in order to realize the EISA goals and satisfy the mandates specified in the law.

III. EPA'S LIFECYCLE ANALYSIS UNDERSTATES THE GHG BENEFITS OF SUGARCANE

The RFS2 Proposed Rule states, "No single model can capture all of the complex interactions required to conduct a complete lifecycle assessment as required by Congress. As a result, the methodology EPA has currently evaluated uses a number of models and tools to provide a comprehensive estimate of GHG emissions."[69] We recognize that completing the required lifecycle analysis presented a difficult challenge. In general, we believe EPA's lifecycle analysis was carefully done and captured many of the complexities of agriculture, land use, and biofuel production worldwide. At the same time, we believe further refinement is warranted and necessary for the final rule to reflect the true greenhouse gas benefits of sugarcane

Lifecycle analysis, by definition, involves a considerable number of variables with complex relationships, and the addition of indirect land use change emissions only exacerbates these complexities. Various stakeholder groups (e.g. Global Bioenergy Partnership, Roundtable on Sustainable Biofuels, and various others) have recommended that EPA simplify the analyses by eliminating some aspects that clearly have minimal to virtually no impact on the model's output.[70] Reaching a consensus on how to best simplify the analysis with an eye toward the overarching goal of reducing GHG emissions would facilitate analyses and comparisons going forward.

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[68] See The White House Office of the Press Secretary, President Obama Announces Steps to Support Sustainable Energy Options, Departments of Agriculture and Energy, Environmental Protection Agency to Lead Efforts (May 5, 2009). , http://www.whitehouse.gov/the_press_office/President-Obama-Announces-Steps-to-Support-Sustainable-Energy-Options/>
[69] See 74 Fed. Reg. at 24916.
[70] See Sustainable biofuels: Prospects and Challenges, The Royal Society, January 2008, Policy Document 01/08. Available at http://royalsociety.org/document.asp?id=7366

In the following pages, we have highlighted only the discrepancies in EPA's lifecycle calculations that lead to a significant change in model results. Under sub-section A, we identify the necessary changes to EPA's "direct" lifecycle calculations, including the need to incorporate the anticipated changes to the sugarcane ethanol pathway through 2022 as well as to include emissions credits for the surplus bioelectricity that displaces other more carbon-intensive energy sources in Brazil. Under sub-section B we address the "indirect" calculations, with a particular focus on the need to incorporate a Brazil-specific land use model into EPA's calculations.

A. NECESSARY ADJUSTMENTS TO "DIRECT" LIFECYCLE CALCULATIONS[71]

EPA has incorporated some of the unique characteristics of sugarcane production systems and processing into the GREET model.[72] However, industry practices continue to evolve, and we believe it is essential that EPA's analysis reflect not only the current state of the Brazilian sugarcane industry but also the ongoing changes that will be implemented regardless of the RFS2 mandates by 2022. This is particularly important given that EPA is developing its scenarios under a "business-as-usual" approach through 2022. Because there are clear business trends and legal requirements that are changing the way sugarcane is grown, harvested, and processed into a renewable fuel, we believe that EPA should incorporate the following industry trends in its scenarios for sugarcane ethanol.

1. <u>Brazilian Sugarcane Industry Trends Through 2022</u>

Throughout the last few years, there have been significant operational improvements in the Brazilian sugarcane industry.[73] These changes will affect the 2022 baseline of EPA's lifecycle analysis because they are ongoing, structural shifts in industry practices. There are at least three inter-related changes that will significantly impact the direct emissions calculations, namely: (1) *a reduction of pre-harvest field burning*; (2) *an increase in mechanical harvesting*; and, (3) i*ncreased cogeneration efficiency*.

First, a growing share of Brazil's sugarcane harvest (approximately 35%) is not burned *and* is mechanically harvested.[74] Second, this mechanical harvesting without pre-harvest field burning

[71] For purposes of consistency we are using EPA's definition of "direct emissions as those that are emitted from each stage of the full fuel lifecycle, and indirect emissions as those from second order effects that occur as consequence of the full fuel lifecycle." See 74 Fed. Reg. at 25023.

[72] GREET is the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model that was created by Argonne National Laboratory. Details are available at http://www.transportation.anl.gov/modeling_simulation/GREET/index.html

[73] 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. An English version of the report is available upon request.

[74] Though the trend is for all sugarcane is to be mechanically harvested and not to be burned, there are mills that still burn the sugarcane in the field but harvest it manually. According to CTC's Annual Report for the 2008 harvest, 47.5% of all harvested cane was mechanically harvested *burned* cane while 35.3% was mechanically harvested from *unburned* (green) cane. See "Relatórios do Controle Mútuo (PAMPA, Agri-Anual e Industrial)." *Centro-Sul Brasil, Safra 2008*. Centro Tecnológico Canaviero (CTC). Web. 1 Aug. 2009. <http://www.ctcanavieira.com.br>.

yields a high amount of additional biomass (commonly referred to as "trash," which includes leaves and tops of cane stalks). Some of this additional biomass is already being recovered and transported to the mill for processing and much more is expected in the very near future.[75] This biomass recovery process increases electricity production through cogeneration (or, in the future, additional ethanol production once cellulosic pathways are commercially viable).[76] Third, as changes in field operations continue, energy efficiency improvements at mills already are adding to the surplus electricity provided to the national grid.[77]

Given that EPA's approach involves establishing business-as-usual baselines for 2022, it is imperative that the Final Rule use the most accurate estimates for reductions of GHG emissions for sugarcane ethanol over a gasoline baseline. As described above, mechanization and cogeneration are common industry practices today that we expect to be rapidly adopted across all plants in the coming years.[78]

These trends are being driven by the following policies and market forces, which do not appear to be accounted for in the Proposed Rule but should be included in the Final Rule.

a) ***Phase Out of Field Burning***. Under current regulations and agreements between the environmental authorities and the sugarcane industry, nearly all of the sugarcane in the State of São Paulo will be mechanically harvested by 2014. (São Paulo accounts for over 50% of all national production and nearly all of the sugarcane ethanol 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).[79] However, UNICA member companies have entered into an agreement with the São Paulo Environmental Agency to move up the deadlines for sugarcane pre-harvest burning to 2014 and 2017, respectively. [80] The agreement also defines other important actions such as conservation programs and restoration projects for riparian corridors as set-aside land policies.[81] Separately, the recently proposed agro-ecological zoning for sugarcane "includes a measure to end the

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[75] See Hassuani ibid.
[76] McNish, Tyler, Arne Jacobson, Dan Kammen, Anand Gopal, and Ranjit Deshmukh. "Sweet carbon: An Analysis of Sugar Industry Carbon Market Opportunities under the Clean Development Mechanism." *Energy Policy* (2009).
[77] 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
[78] 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).
[79] 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
[80] See "Protocolo Agro-Ambiental do Setor Sucroalccoleiro Paulista," available in Portuguese at http://www.ambiente.sp.gov.br/cana/protocolo.pdf
[81] 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).

practice of crop burning by 2017 in all areas suitable for mechanized harvesting."[82] Should this legislation[83] be approved, the São Paulo state requirement to phase out mechanical harvest by 2017 would become national law.

b) ***Increasing Restrictions on Cane Burning.*** Existing plantations that still use manual harvesting in the state of São Paulo must now 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).[84] This uncertainty has caused many producers to switch to mechanical harvesting to eliminate associated operational risks.

c) ***Sugarcane Expansion only with Mechanization.*** Since 1986 all new sugarcane plantations and mills have been required to submit environmental impact studies prior to construction and operation in order to obtain the required permits.[85] More recently, in order to receive a permit to establish green-field sugarcane mills, as a result of the new laws that phase out pre-harvest sugarcane burning, the São Paulo state environmental authorities now require new licensees to show how they will achieve 100% mechanical harvesting. [86] Other states are in active discussions to follow São Paulo's lead and, as noted above, the federal agro-ecological zoning would require mechanized harvest nationwide. [87]

d) ***Over One-Third of Harvest Mechanization Nationwide*.** 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 (CTC), which has undertaken benchmarking and data collection in the Brazilian sugarcane industry for decades, about 47.5% of all sugarcane in Brazil is already mechanically harvested, and 35.3% of all sugarcane in Brazil is mechanically

[82] Brazil. Presidency of the Republic. Secretariat of Communications (SECOM). *Brazil Increases Environmental Preservation Measures With Sugarcane Zoning Proposal*. PR Newswire, 17 Sept. 2009. Web. 17 Sept. 2009. <http://sev.prnewswire.com/agriculture/20090917/SPTH00117092009-1.html>.
[83] For a copy of the proposed legislation (in Portuguese), see http://www.planalto.gov.br/ccivil_03/Projetos/PL/2009/msg764-090917.htm
[84] 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.
[85] 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
[86] 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.ph[- 2009 and http://sigam.ambiente.sp.gov.br/sigam2/default.aspx?idPagina=123
[87] See statements by Environment Minister Carlos Minc on this as well as the environmental and economic zoning being prepared by an inter-ministerial group of the Brazilian government and expected to be publicly announced shortly. Available online at http://www.mma.gov.br

harvest without being burned in the field. [88] In 2008, well over half of the sugarcane fields in the state of Sao Paulo were mechanically harvested and not burned (green cane). And other states such as Goiás, Mato Grosso do Sul, and Paraná are also implementing mechanical harvest with green cane. In fact, the robust pace of mechanization was recently highlighted in a John Deere earnings release that states, "sales are being helped by […] rising demand for sugarcane harvesting equipment."[89]

As an aside, and perhaps not relevant for the RFS2, but nevertheless of great importance to our industry and other stakeholders, there is a clear ongoing trend to improve the sustainability – not just environmental but also social and economic – of the sugarcane industry in Brazil. For instance, UNICA has launched an aggressive effort to address the implications, particularly in the labor force, of the rapid change caused by the aforementioned industry trends. For instance, UNICA has joined forces with the Inter-American Development Bank and other organizations[90] to launch a large-scale training and requalification program, known as RenovAção. Every year, 7,000 workers and members of the local communities will be trained in various sugarcane-producing regions of the State of São Paulo. In addition to ensuring workers are prepared for the new opportunities in the evolving sugarcane industry, UNICA has been active in multi-stakeholder efforts, including the Better Sugarcane Initiative, the Roundtable on Sustainable Biofuels, the Global Bioenergy Partnership, and many others. The results of these efforts are highlighted in the UNICA's Annual Sustainability Report, which met the requirements of the Global Reporting Initiative and is available on UNICA's website. [91]

In summary, any realistic evaluation of carbon emissions from sugarcane farming in Brazil must reflect that the above policies have caused (and will likely continue to cause) a phase-out of sugarcane burning, and an increase in mechanical harvest and, as explained below, an increasingly large surplus of cogeneration electricity output. In an effort to ensure that the Final Rule would represents a robust and scientifically credible approach, we believe EPA should consider and account for these factors in its scenarios for the sugarcane ethanol pathway. In the next section we will show how these trends impact the "direct" lifecycle of sugarcane ethanol.

2. <u>Emission Credits from Cogeneration Surplus</u>

According to the Proposed Rule, EPA "factors in credits from [sugarcane bagasse] excess electricity based on offsetting the Brazilian electricity grid." However, the Proposed Rule has to be adjusted given the fact that cogeneration in Brazil displaces the marginal power supplier (i.e., thermoelectric power plants, running on natural gas or heavy fuel oil) not the average grid

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[88] "Relatórios do Controle Mútuo (PAMPA, Agri-Anual e Industrial)." *Centro-Sul Brasil, Safra 2008*. Centro Tecnologico Canaviero (CTC). Web. 1 Aug. 2009. <http://www.ctcanavieira.com.br>. CTC has a sample of 167 mills and, therefore, has been accepted as the preeminent benchmark for the sugarcane industry in Brazil.
[89] 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
[90] Those include Case IH, Deere & Co., Syngenta Federation of Rural Workers of the State of São Paulo (FERAESP).
[91] *Sustainability Report.* Tech. Sao Paulo, Brazil: UNICA, 2008. http://www.unica.com.br/download.asp?mmdCode={D1814075-0E5C-4BFB-BA2C-EF428FF58F33}

electricity (i.e., predominantly hydroelectric). This is a fundamental flaw, which if not addressed may result in an arbitrary and capricious rulemaking. The faulty current analysis significantly alters the direct emissions of sugarcane ethanol, particularly as EPA projects out to 2022, as well as undermines the scientific integrity of the Agency's work in combating climate change. For EPA's lifecycle analysis to be credible, thorough, and accurate, it must take into account the nature of the power generation being displaced; in this case, fossil fuel generation with higher greenhouse gas emissions. Recognizing that cogeneration of electricity from sugarcane bagasse effectively displaces the *marginal*, not the average grid, electricity in Brazil —*ceteris paribus*— the results of EPA's lifecycle analysis would change from 44 percent to 57 percent GHG reduction compared to baseline gasoline in the 100 year, 2% discount scenario.[92] Depending on the assumptions made on the increases of sugarcane mechanization in Brazil (i.e., increased biomass energy utilization described below), these results could show an even greater emissions reduction.

The benefits of bioelectricity have been analyzed from the standpoint of lifecycle analysis in various studies, which generally all concur that sale of surplus electricity form cogeneration of sugarcane bagasse can significantly contribute to carbon mitigation.[93, 94, 95] Generally, scientists have established that emissions can be assigned to by-products of the bioenergy chain and to the energy product in many ways; the choice of method for allocation depends on the specific by-product in case.[96] The emission assignment may consider: use of the displacement method, the energy content, the mass, the market value, and a specific reference scenario for the biomass/ processes under consideration. When bioenergy is the main product, the *displacement method* is usually selected. Basically, the *displacement method* takes into account the service offered by the by-product and how (and with what amount of net CO_2 emissions) that service would have been delivered in the absence of the by-product. (This, in fact, is quite similar to the indirect land use argument.) These net CO_2 emissions are credited to the biomass fuel chain for providing the by-product.

Cogeneration in Brazil should be given emission reduction credits relative to the marginal power supply in the context of EPA's lifecycle analysis. The United Nations Framework Convention on Climate Change (UNFCCC), under the Clean Development Mechanism (CDM), establishes methodology for electricity generation from biomass residues.[97] The CDM

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[92] Calculation is done by changing (a) electricity at the margin with GREET natural gas methodology, (b) yield of 27 gallons per ton of cane; and (c) 1.78kWh/Gal in EPA-HQ-OAR-2005-0161-0956 spreadsheet.
[93] McNish, Tyler, Arne Jacobson, Dan Kammen, Anand Gopal, and Ranjit Deshmukh. "Sweet carbon: An Analysis of Sugar Industry Carbon Market Opportunities under the Clean Development Mechanism." *Energy Policy* (2009).
[94] Barroso, Luiz Augusto, Priscila Lino, Sergio Granville, Leonardo Soares, and Mario Pereira Veiga. "Cheap and clean energy: Can Brazil get away with that?" *Power and Energy Society General Meeting - Conversion and Delivery of Electrical Energy in the 21st Century, 2008 IEEE* (July 2008): 1-8.
[95] Nguyen, Thu Lan, John Hermansena, and Masayuki Sagisaka. "Fossil energy savings potential of sugar cane bio-energy systems." *Applied Energy* 86.1 (Nov 2009): S132-139.
[96] Campbell, J., D. Lobell, and C. Field. "Greater Transportation Energy and GHG Offsets from Bioelectricity Than Ethanol." *Science Science* 324 (22 May 2009): 1055-057.
[97] "CDM: Consolidated Methodology for Electricity Generation from Biomass Residues - Version 9." CDM: CDM-Home. Web. 1 Sept. 2009. <http://cdm.unfccc.int/methodologies/DB/XFJ41S3J17TLQCW904D26WJK7ST8TL/view.html>.

methodology clearly establishes that in the case of sugarcane bagasse, the emissions should be compared with the combined margin, not the grid average.[98] The World Bank has echoed this view saying, "Bagasse cogeneration projects reduce CO_2 emissions by substituting for electricity produced by thermal plants."[99]

The question then – much like the *indirect* land use change question – is what amount of additional net CO_2 emissions would be produced by the Brazilian power system to provide the same energy, absence the surplus of electricity supplied as a by-product of sugarcane ethanol and sugar production. The next three sub-sections will address (a) the growth of cogeneration in Brazil, (b) the characteristics of the Brazilian electricity system, and (c) the emissions savings resulting from bioelectricity use that EPA should consider for the Final Rule.

a) Cogeneration 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 on the sale of surplus cogeneration electricity.[100] 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 significant volumes of electricity. [101] In 2007, mills produced about 11,095 GWh, which corresponds to about 22.5 kWh per ton of raw sugarcane crushed.[102] In 2008, the Brazilian Ministry of Mines & Energy calculated that sugarcane power cogeneration increased to 15,768 GWh, netting 4,409GWh.[103]

This increase is a result of not only increased sugarcane production but, more importantly, new mills upgrading to high-pressure steam cycle generators that produce at least 70 kWh per ton of cane with bagasse alone.[104] Moreover, more efficient mills are entering into long-term

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[98] See UNFCCC/CCNUCC's CDM Executive Board, "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002). <http://cdm.unfccc.int/UserManagement/FileStorage/NF9EDAOV5K382HW0JR14GS7XYQUMCP>.

[99] The World Bank. Development Committee. *Clean Energy for Development Investment Framework: The World Bank Group Action Plan*. The World Bank, Clean Energy for Development Investment Framework (CEIF), 28 Mar. 2007. Web. 1 Aug. 2009. <http://siteresources.worldbank.org/DEVCOMMINT/Documentation/21289621/DC2007-0002(E)-CleanEnergy.pdf.>

[100] Granville, Sergio, Priscila Lino, Leonardo Soares, Luiz Augusto Barroso, and Mario Pereira. "Sweet Dreams are Made of This: Bioelectricity in Brazil." IEEE Xplore: Guest Home Page. June 2007. Web. 1 Aug. 2009. <http://www.psr-inc.com/psr/download/papers/IEEE_GM2007_Barroso_This_Bioelectricity_Brazil.pdf>.

[101] Duff, Andy, and Rodolfo Hirsch. *Power Struggle: The Future Contribution of the Cane Sector to Brazil's Electricity Supply*. Sao Paulo, Brazil: Rabobank, F&A Research and Advisory, November 2007.

[102] Sugarcane harvest was 493 million metric tonnes of sugarcane according to actual production data compiled by UNICA and available at http://www.unica.com.br/dadosCotacao/estatistica/. Data for current power 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.

[103] Patusco, Oao Antonio Moreira. "Balanço Energético Nacional – Ano Base 2008 – Dados preliminares – MME." 11 Aug. 2009. E-mail. 2008 data estimates provided by Brazilian Ministry of Mines & Energy (MME).

[104] 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).

supply contracts with power distribution companies.[105] Based on expert estimates, a reasonable approximation is that cogeneration surplus for 2022 will be in excess of 115,000 GWh.[106] These are based not only on the fact that there will be additional electricity incorporated into the grid every year through 2022, either through the scheduled government auctions or via open market sales,[107] but also, 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).[108]

In order to provide a full picture of how large the electricity surplus is already, and in hopes of corroborating the national data provided by the Ministry of Energy, UNICA surveyed every mill that is a member of the trade association and obtained data for electricity surplus fed into the grid in 2008. Of the 124 mills that are UNICA members, 39 mills reported exporting a total of 3,062 GWh electricity surpluses into the grid in 2008.[109] Based on the considerable sample (about two-third of all sugarcane produced in Brazil in 2008), the average cogeneration surplus for all sugarcane mills in Brazil was estimated at 10.5 kWh/t in 2008. And, if we only include the 39 mills that reported providing surplus electricity to the grid, the average for the exporting mills was approximately 25 kWh/t in 2008, which is nearly equal to the values proposed by Michael Wang in GREET.[110] Finally, as proof that improvements are ongoing, about 20% of the mills are already producing 40 kWh/t and the overwhelming evidence is that this growth trend will continue, both in scope and scale.

As we detailed in our earlier comments to the State of California's Air Resources Board during the Low Carbon Fuel Standard (LCFS) proceedings, which UNICA submitted to the EPA Docket for the RFS2 on September 2,[111] sugarcane mills in Brazil will soon produce averages of 75kWh/t by using all bagasse in high-pressure steam systems.[112] However, since the trend towards mechanization (i.e., no cane burning) is well underway (i.e., roughly half of harvested area),[113] experts point out that it is reasonable to expect that by 2022 average mills will have

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[105] See "Brazil to invest $21.2 billion in cogeneration" in The Economist Intelligence Unit (1 December 2008).
[106] See COGEN-SP for additional data and information, http://www.cogensp.com.br/cogensp/workshop/2008/Bioeletricidade_ENASE_01102008.pdf
[107] Silvestrin, Carlos Roberto. "Bioeletricidade - Reduzindo Emissões e Agregando Valor ao Sistema Elétrico Nacional." *COGEN/SP*. Presentation made at Ethanol Summit in Sao Paulo, Brazil., 2 June 2009. Web. 1 Sept. 2009.
[108] For further details, please review Technical-Economic Evaluation for the Full Use Sugarcane Biomass in Brazil, [author's translation from Portuguese], Joaquim Seabra, Universidade Estadual de Campinas, July 2008.
[109] More detailed supporting information was provided to CARB on a "Confidential Business Information" basis in June 2009.
[110] 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.
[111] See "Comment submitted by Brazilian Sugarcane Industry Association (UNICA), Document ID EPA-HQ-OAR-2005-0161-1761.1." Letter to Environmental Protection Agency, Docket EPA-HQ-OAR-2005-0161. 2 Sept. 2009. MS. EPA/OTAQ, Washington, DC.
[112] See pages 5-10 of our April 16 letter to CARB.
[113] 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.

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.[114]

b) Understanding Brazilian Electricity Grid

In order to determine appropriate emission credits for sugarcane cogeneration surplus provided to the electricity grid, it is important to understand the basic characteristics of the Brazilian electricity grid.[115]

The current electricity matrix in Brazil is dominated by hydroelectric power, which accounts for about 80% (in normal hydrology) of the country's total electricity supply, making it the world's most hydro-dependent large-scale electricity grid in the world.[116] Due to this unique characteristic, Brazil has developed a national, centrally dispatched interconnected electricity grid, which according to official government data generated 496TWh of electricity in 2008.[117] The national system operator (known as ONS in Portuguese) controls the dispatch of electricity by hydroelectric and other power generators to ensure that the system as a whole is operating at its peek efficiency and given particular consideration to the amount of hydroelectricity being used (i.e. the hydrological risk of future power shortages by depleting water reservoirs). As a result of this unique system, thermal power plants are dispatched in order to allow for hydroelectric power sources to store water in reservoirs. In other instances, localized transmission restrictions require thermoelectric power generators to meet temporary demand instead of hydroelectric plants.[118] For instance, in 2008, while 80% of total electricity consumed was from hydroelectric sources, thermal power production from biomass represented 5.3% while thermal from fossil fuels represented 11.6% (mostly natural gas but also heavy fuel oil, coal and derivatives).[119]

According to all experts in the Brazilian power generation market, including the U.S. Energy Information Agency,[120] hydroelectricity's share in the electricity matrix will reduce as the

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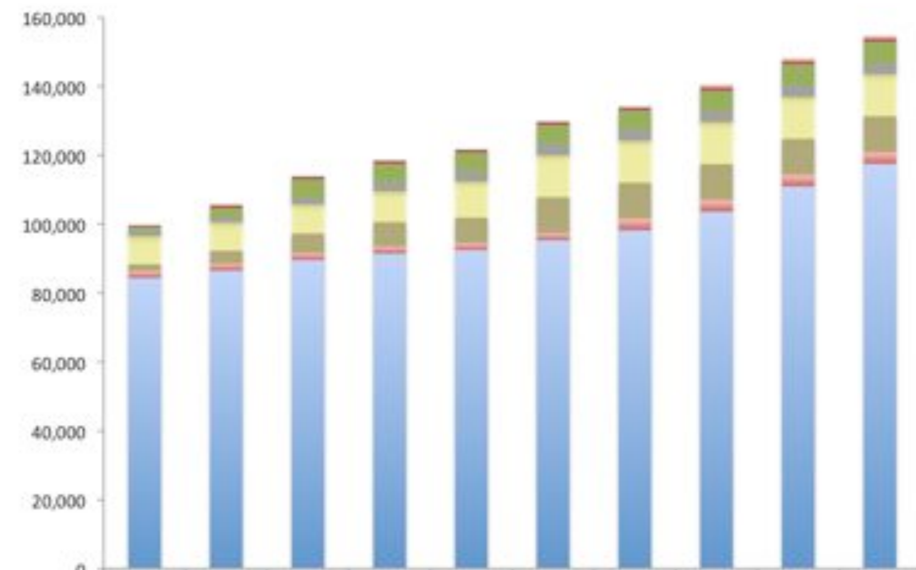
[114] Macedo, Isaias C., Joaquim Seabra, and Joao Silva. "Greenhouse gases emissions in the production and use of ethanol from sugarcane in Brazil: The 2005/2006 averages and a prediction for 2020." Biomass and Bioenergy 32.7 (2008): 582-95.
[115] For general background on Brazil's electricity sector, see "Brazil: Country Analysis Brief." *U.S. Energy Information Administration (EIA)*. U.S. Department of Energy (DOE), Oct. 2008. Web. 1 Sept. 2009. http://www.eia.doe.gov/cabs/Brazil/Full.html. For a review of the recent regulatory changes, see Chapter 3 of Jose Jaime Millan. *Market or state?: Three decades of reforms in the Latin American electric power industry*. Washington, DC: Inter-American Development Bank, June 2007. Sustainable Development Department, June 2007. Web. 1 Sept. 2009. <http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=1585746 >.
[116] "Brazil: Country Analysis Brief." *U.S. Energy Information Administration (EIA)*. U.S. Department of Energy (DOE), Oct. 2008. Web. 22 Sept. 2009. <http://www.eia.doe.gov/cabs/Brazil/Full.html>.
[117] Brazil. Ministry of Mines & Energy (MME). Energy Research Company (EPE). *Balanço Energético Nacional - 2009*. EPE/MME, July-Aug. 2009. Web. 10 Sept. 2009. <https://ben.epe.gov.br/>.
[118] For a detailed discussion of this, see (a) Marques, T. C., M. A. Cicogna, and S. Soares. "Benefits of Coordination in the Operation of Hydroelectric Power Systems: The Brazilian Case." *IEEE's Power Engineering Society General Meeting* (2006). *IEEE Xplore*. 16 Oct. 2006. Web. 15 Sept. 2009. http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=1709574 (b) Street, Alexandre, L. A. Barroso, B. Flach, M. Pereira, and S. Granville. "Risk Constrained Portfolio Selection of Renewable Sources in Hydrothermal Electricity Markets." *IEEE Transaction on Power Systems* 24.3 (2009): 1136-144.
[119] Brazil. Ministry of Mines & Energy (MME). Energy Research Company (EPE). *Balanço Energético Nacional - 2009*. EPE/MME, July-Aug. 2009. Web. 10 Sept. 2009. <https://ben.epe.gov.br/>.
[120] IBID.

country's electricity demand increases.[121] This shift is due not only due to a significant increase in electricity demand (which is estimated to have between 3.5% and 5% annual growth through 2030) but also due to a significant slow down in the construction of new hydroelectric plants in last decades. Construction new hydroelectric plants are now only possible in very remote (and environmentally sensitive) areas, such as the Amazon.[122] In fact, the Brazilian government's official projections for the expansion of the generation system indicates that from 2008 to 2017 the installed capacity for hydroelectricity will decrease from 82% to nearly 70%. Moreover, the same analysis indicates that there will be a substantial increase in the use of fuel oil at thermal power plants (from less than 1% to near to 6%).[123]

Brazilian Electricity Expansion by Sources (2008-2017)



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Misc								900	900	900
Process Gas & Steam	469	959	959	959	959	959	959	959	959	959
Renewable Biomass & Wind	1,256	2,682	5,420	5,479	5,479	5,593	5,593	5,913	6,233	6,233
Charcoal	1,415	1,415	1,765	2,465	2,815	3,175	3,175	3,175	3,175	3,175
Natural Gas	8,237	8,237	8,453	8,948	10,527	12,204	12,204	12,204	12,204	12,204
Fuel Oil & Diesel	1,984	3,807	5,713	7,153	7,397	10,463	10,463	10,463	10,463	10,463
Nuclear	2,007	2,007	2,007	2,007	2,007	2,007	3,357	3,357	3,357	3,357
Hydroelectric	84,374	86,504	89,592	91,480	92,495	95,370	98,231	103,628	110,970	117,506

Source: *Plano Decenal de Expansão de Energia (PDE)*.

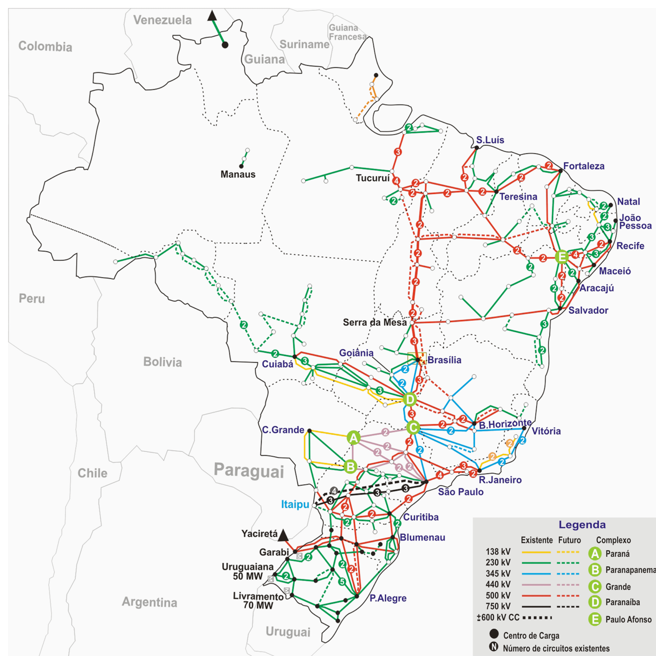
The trend toward greater use of fossil fuels in power generation is exacerbated by the smaller water reservoirs in new hydroelectric sources, according to a recent presentation by the ONS at

[121] *Energy and Electricity Report Brazil*. Publication. London, UK: Economist Intelligence Unit, Aug 2009. *EIU Industry Reports*. Web. 1 Sept. 2009. <http://portal.eiu.com/>.
[122] Even when considering additional hydroelectric power expansion, emissions calculations should include transmission impacts, direct and indirect land use changes. For a recent account of this, see "Doubt, Anger Over Brazil Dams; As Work Begins Along Amazon Tributary, Many Question Human, Environmental Costs" in *The Washington Post* on October 14, 2008.
[123] Brazil. Ministry of Mines & Energy (MME). Energy Research Company (EPE). *Plano Decenal de Expansão de Energia (PDE)*. Spring 2008. Web. 15 Sept. 2009. <http://www.epe.gov.br/PDEE/Forms/EPEEstudo.aspx>.

an industry conference in Brazil.[124] According to one recent report from the Brazilian Association of Thermal Power Generators (ABRAGET), the water reservoirs in 1970 corresponded to 28 months of operation but in 2008 the reservoirs corresponded to only 6 months. More interestingly, ABRAGET's report indicates that in the absence of thermoelectric power, the level of water in the reservoirs would be would be one third less.[125]

These constraints on the hydroelectric supply have significantly limited the capacity for multi-annual regulation of the large reservoirs by the system operator, forcing the increasing installation and dispatch of thermal power to help the supply system in dry (critical hydrology) season. Thermal power systems have been dispatched three to four times more often than initially planned, ABRAGET analysis shows. The new thermal based units, due to high fuel costs, are dispatched only when the hydrology requires it.

The question then arises over how the operational plans for the grid are developed and what is their dispatch order vis-à-vis bioelectricity.[126] The ONS evaluates projected energy demand in various sources of demand in the four main sub-systems of the interconnected Brazilian electricity grid (i.e., South, Southwest, North, and Northeast) for the next ten years. (See ONS map of Brazilian grid on the right.[127]) As part of this operational planning, the ONS takes into consideration the limitations on the transmission of power between regional subsystems and hydrological scenarios to determine the best dispatch policy for stable energy supply, within the five percent limit for the risk of energy shortage. The ONS then dispatches power generation unit for each sub-system while considering both the specific costs and varying technical restrictions of each generator. As a safety precaution,[128] particularly after the 2001 energy rationing, the ONS will displace thermal power plants beyond specific cost considerations in order to store water in the reservoirs. [129]



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[124] Chipp, Hermes. "Desafios para a operação em um sistema com maior participação térmica." Proc. of Segurança para o Sistema: Operando uma Matriz Hidrotérmica, Fórum Matriz Hidrotérmica e a Segurança do Sistema Elétrico Nacional, Rio de Janeiro, Brazil. 20 Aug. 2009. Web. 15 Sept. 2009. <http://www.ctee.com.br/termica/programacao.asp>.

[125] Ponchmann da Silva, Edmundo. *Analise dos Leiloes de Energia Eletrica*. Tech. Sao Paulo, Brazil: ABRAGET, Aug 2009

[126] Street, Alexandre, L. A. Barroso, B. Flach, M. Pereira, and S. Granville. "Risk Constrained Portfolio Selection of Renewable Sources in Hydrothermal Electricity Markets." *IEEE Transaction on Power Systems* 24.3 (2009): 1136-144.

[127] See http://www.ons.org.br/conheca_sistema/mapas_sin.aspx

[128] See updated graphic of the hydrological variations in Brazil at http://www.grupocanalenergia.com.br/reservatorios/reserv.asp?regiao=Sudeste

[129] For a detailed discussion of the energy rationing and implications for Brazil's power sector, see Chapter 3 of Jose Jaime Millan. *Market or state?: Three decades of reforms in the Latin American electric power industry*. Washington, DC: Inter-

As a rule, the ONS dispatch order in Brazil is: Hydroelectric, Wind, Nuclear, Imports from other Sub-Systems (ordered by increasing costs) and, finally, thermal power (ordered by increasing cost).[130] Sugarcane bagasse-based power generation units are classified as “inflexible thermal based systems” given they are always dispatched when the mill is operating. Consequently, they are in the lowest range in terms of “variable unit cost (CVU, in Portuguese) for the thermal systems.[131] It is also important to note that the ONS considers that the energy sugarcane mills supply to the grid allows for the reduction of the use of other thermal power plants, with higher costs, which would have been dispatched for hydrological safety reasons.

c) Emissions Credits from Bioelectricity

The emissions avoided by the bagasse generated energy surplus today are well represented by the emission factor for the electricity grid’s operating margin. All bagasse-derived energy supplied to the grid is accounted in the operational procedures as saving water in the hydro reservoirs, therefore reducing the need to dispatch *at the margin* power generators fueled by natural gas or other fossil fuels. Under the IPCC auspices, some methodologies have been used for its evaluation, such as simple or adjusted margin, dispatch data analysis, or average operating margin. However, the use of the dispatch data is the most recommended by IPCC.[132]

The emission factor can be calculated as the weighted average of the emission factors for the power generation units supplying the 10% (of total dispatched energy) at the lowest priority dispatch (calculated each hour). As an example, the table below presents the average fuel mix for electricity generation in the grid’s operating margin in December 2008, based on dispatch data provided by ONS for each hour of the day during that month, the latest available.[133] (It is expected that the government will make additional data available in the coming months.)

Average Fuel Mix for Electricity Generation in Brazilian Grid’s Operating Margin (December 2008)

Hydro	1.11%
Wind	0.24%
Nuclear	18.99%
Natural gas	60.24%
Coal	14.37%
Diesel or Fuel oil	3.63%
Coke-oven gas	1.41%

Source: MCT (2009), based on from ONS data for Dec 2008.

American Development Bank, June 2007. Sustainable Development Department, June 2007. Web. 1 Sept. 2009. <http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=1585746>.

[130] Ibid.

[131] Bagasse power has a CVU less than R$100 per MWh, while some fuel oil, diesel and LNG have CVU over R$300 per MWh according to ONS.

[132] "CDM: Consolidated Methodology for Electricity Generation from Biomass Residues - Version 9." CDM: CDM-Home. Web. 1 Sept. 2009. <http://cdm.unfccc.int/methodologies/DB/XFJ41S3J17TLQCW904D26WJK7ST8TL/view.html>.

[133] Brazil. Ministry of Science & Technology (MCT). Secretariat of Policy and Research & Development (SEPED), Climate Change Coordination. *Identificacao do perfil de fontes de energia e consumo de combustivel da margem de operacao do Sistema Interligado Nacional*. By Ana Carolina Avzaradel. Brasilia, DF: MCT/SEPED, 2009.

In conclusion, considering the predominant use of natural gas thermal plants in the Brazilian operating margin generation mix, and recognizing that the margin would grow with fossil fuels in Brazil, we suggest the adoption of natural gas emission factors for electricity credits evaluation within the displacement method, which would result in an emissions credit sugarcane cogeneration electricity surplus. *Ceteris paribus*, EPA's lifecycle analysis should be adjusted from 44% to 57% GHG reduction compared to baseline gasoline in the 100 year, 2% discount scenario.

3. Clarifications Requested

In the course of our review of EPA's lifecycle analysis a number of questions have been raised with EPA staff that remain unanswered. In order to ensure the most accurate full lifecycle analysis of the sugarcane ethanol pathway, we believe that EPA should provide answers given its stated goal of transparency and scientific-integrity prior to finalizing the lifecycle analysis.[134] Questions for which UNICA requests clarification:

a) ***Cane Burning.*** How was sugarcane straw burning calculated in the lifecycle? As noted in our letter to CARB's LCFS as well as in GREET methodology, the average trash (leaves and tops) is 0.14 t (dry mass)/t cane stalks.

b) ***Straw Yield.*** What volumes of straw harvested and percentages of that straw process at mill has EPA assumed for today as well as for 2022 scenarios? As noted earlier in this section, the rapid increases in mechanization suggest that 2022 estimates could be understated. EPA should carefully review its estimates and, hopefully, make the information transparent to stakeholders.

c) ***Transportation in U.S.*** Is EPA not double-counting transport emissions in the United States for sugarcane ethanol? In EPA's spreadsheet EPA-HQ-OAR-2005-0161-0950.3, emissions related to the item "Fuel Production" are calculated from a table entitled "Sugarcane Ethanol Production & Transport in the U.S. per mmBtu Fuel." Apparently, the values were taken from GREET and are said to include ethanol distribution in the United States. If this is the case, the item "Other (fuel and feedstock transport)," which also includes ethanol transport inside the U.S., represents a double counting of the same emissions and should be corrected in the Final Rule.

d) ***Ocean Transport.*** How is the "haul back" shipping emissions calculated in the EPA model? When using GREET for calculating the fuel oil needed for ethanol transport from Brazil to the United States, some have mistakenly assumed that ocean tankers

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[134] EPA Office of the Science Advisory, Guidance on the Development, Evaluation, and Application of Environmental Models, EPA/100/K-09/003, at 48 (Mar. 2009). Available online at http://www.epa.gov/fedrgstr/EPA-RESEARCH/2009/March/Day-31/r7183.htm

would return to Brazil empty (almost doubling the fuel consumption). We have found that GREET would not allow setting the "haul back" value to zero, so would recommend it setting it to close zero so as not to artificially inflate transportations emissions.

e) *Choice of IPCC Data.* Apparently EPA has chosen to use IPCC's Global Warming Potential (GWP) factors from the second assessment report instead of the more recent 2007 updated values. Is that the case? If so, what is EPA basis for choosing the older GWP values for RFS2?

B. IMPROVING "INDIRECT" LIFECYCLE CALCULATIONS

The inclusion of emissions associated with indirect land use changes (ILUC) in lifecycle modeling has been controversial[135] and the source of various academic analysis,[136] critiques,[137] and policy recommendations.[138] We believe the science of indirect effects is evolving and may not be ready for regulatory action. Putting aside the ILUC debate, in this section, we will focus on eight key areas of EPA's indirect lifecycle calculations that require improvements prior to the Final Rule.

1. Land Allocation Models do not Provide the Answers EPA Needs

Although different methodological alternatives can be established for measuring GHG emissions associated to ILUC, there is a broad consensus among experts that the methodologies rely on the combination of geospatial analysis, for defining the past and the current land use changes, and economic-based models that should use information from geospatial analysis as inputs for projecting supply, demand, land use and land competition for agricultural products.

Partial equilibrium worldwide models, as FAPRI's world models, were developed to measure land allocation and need additional improvements to project land use changes. Those improvements imply the development of detailed national models that are able to capture change in land use within the countries and not only on the country. Likewise a detailed model has been used for United States (e.g., FASOM), similar models should also have been used for other countries.

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[135] Power, Stephen. "If a Tree Falls in the Forest, Are Biofuels To Blame? It's Not Easy Being Green." *The Wall Street Journal* [New York, NY] 11 Nov. 2008. Web. 1 Sept. 2009. <http://online.wsj.com/article/SB122636711059015989.html>.
[136] Rathmann, Regis, Alexandre Szklo, and Roberto Schaeffer. "Land use competition for production of food and liquid biofuels: An analysis of the arguments in the current debate." *Renewable Energy* 35.1 (2009): 14-22.
[137] Liska, Adam, and Richard Perry. "Indirect land use emissions in the life cycle of biofuels: regulations vs science." *Biofuels, Bioproducts and Biorefining* 3.3 (17 Apr 2009): 318-28.
[138] G. Phillip Robertson et al. "Sustainable Biofuels Redux: Science-based policy is essential for guiding an environmentally sustainable approach to cellulosic biofuels." *Science* 5898th ser. 322 (2008): 49-50

The unavailability of country specific models, as well as lack of detailed geospatial information to define country-based patterns of land use changes, lead EPA to establish a methodology that does not reflect the best science available at this time. Some methodological choices made, such as the assumption that pastures and savannas displaced should necessarily be compensated over other landscapes displacing forest and shrubland, reveal the scientific uncertainty of the analysis in the Proposed Rule.

We recognize the Administrator's public statement that, prior to the Final Rule, EPA will "quantify the uncertainty associated with specifically the international indirect land use change emissions."[139] Given the Proposed Rule's shortcomings in terms of geospatial analysis and economic modeling, EPA should adopt a wider range of assumptions with respect the values of CO_2 emissions released.

2. Use Regional Models when Available

EPA has relied of the FAPRI[140] model as the primary tool for calculating indirect land use changes outside the United States. We believe that while the FAPRI model can be used on a global level, EPA should defer to regional or sub-national models whenever these are available.[141] For the Final Rule, UNICA respectfully submits that EPA use the Brazil Land Use Model (BLUM), which has been developed by researchers in Brazil in coordination with FAPRI modelers at Iowa State University. As the authors indicate, BLUM "represents at a *regional* level the dynamics of the Brazilian agricultural sectors, capturing cause-effect relations that are not available by international or nationwide models." [142]

Using conservative assumptions, BLUM indicated that under the RFS2 scenarios, sugarcane ethanol GHG reductions compared to gasoline would be 69 percent and 60 percent for 100 year with a 2% discount rate and 30 years with no discount rate, respectively. In their submittal to EPA, BLUM modelers recognized the conservative nature of their results by stating:

> "First, we have used an overestimated total area available for agriculture though it is quite reasonable to expect that competition effect would have been stronger than scale effect, thus diminishing expansion over natural vegetation. Second, we are incorporating significant amounts of "International farm inputs and Fert N2O" (as estimated by the original RFS-2 DRIA), which is also associated with international LUC. This, in turn, is, by hypothesis, not considered here, since we hold the Brazilian net exports to avoid international leakage."[143]

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[139] Jackson, Lisa P. "EPA Administrator's Letter." Letter to U.S. Senator Tom Harkin (D-Iowa). 23 Sept. 2009. MS. Environmental Protection Agency, Washington, DC.

[140] FAPRI standard for the Food & Agriculture Policy Research Institute . The FAPRI model is a joint effort of Iowa State University's Center for Agricultural and Rural Development (CARD) and the University of Missouri-Columbia. For more information, see http://www.fapri.iastate.edu/

[141] *Workshop on Lifecycle Greenhouse Gas Analysis for the Proposed Revisions to the National Renewable Fuels Standard Program*, EPA/OTAQ Cong. (2009) (testimony of Andre Nassar). All presentations, as well as audio transcript, are available online at http://client-ross.com/lifecycle-workshop/

[142] Nassar, Andre M. "Comment submitted by Andre M. Nassar, Institute for International Trade Negotiations, The Brazilian Institute for International Negotiations (ICONE)." Letter to Environmental Protection Agency, Docket EPA-HQ-OAR-2005-0161. 11 Sept. 2009. *Regulations.gov*. EPA Docket, 14 Sept. 2009. Web. 14 Sept. 2009. <http://www.regulations.gov/>.

[143] Ibid.

3. Capture Cattle Dynamics

Lack of pasture as a class of land use in FAPRI's world models and the presumption of no pasture intensification in the Winrock International methodology to calculate GHG emission is the central weakness of EPA analysis. This is a fundamental flaw not only because pasture occupies more than 200 hundred million hectares (76 percent of the current agricultural land, or roughly one head of cattle per hectare) but mainly because a large share of the pastureland is under low slope areas. In other words, pasture is a well suited "land releaser" for crops. Combining the previous low levels of intensification, which is measured by stocking rate indexes (number or animals per hectare), and large convertibility of pastures to crops, would allow EPA's modeling for the RFS2 to capture the pasture intensification in the projections of land use change.

Not surprisingly, BLUM has undertaken such phenomena and was able to develop methodologies to more accurately capture the dynamics of Brazilian agriculture, thereby assessing pasture intensification, and, consequently, having land availability and suitability as inputs for the model, estimated indirect land use changes. "One of the most important advantages of BLUM for the RFS-2 regulations is that the model measures not only land allocation but also land use changes. Having the results on land use change estimated through an economic model, carbon emissions can be more accurately calculated by multiplying the land use changes for specific sub-national region by corresponding CO_2-e emissions factors. […] This is an important differential since it makes the calculation simpler and more accurate than the two-step approach developed by Winrock International for the RFS-2 DRIA."[144]

4. Use Geospatial Information Available in the Countries

As EPA admits, while "FAPRI model does predict how much crop land will change in other countries but does not predict what type of land such as forest or pasture will be affected."[145] Consequently, EPA chose to use remote sensing imagery for a limited period of time (2001-2004) to estimate how recent changes in land use have affected forest, grassland, savanna and scrubland. This methodology has a number of shortcomings. First, it was based in the gathering of primary satellite imagery, without any validation, and not in geospatial maps available in Brazil. Since 2001 INPE has been assessing Amazon deforestation using geospatial information, making available for external consultations annual LANDSAT shape files with maps interpreting land use changes promoted by the deforestation. Those satellite imageries are more detailed and accurate than the ones collected and interpreted by Winrock International. Second, as four of the five EPA reviewers[146] suggested, by looking at remote sensing data for period when sugarcane production in Brazil was flat (Note: Brazil was expanding the production of soybean, a completely unrelated crops), it is likely that the methodology is not accurately capturing the

[144] Ibid.
[145] See 74 Fed. Reg. at 25026
[146] See http://www.epa.gov/otaq/renewablefuels/rfs2-peer-review-land-use.pdf

dynamics of Brazilian agriculture.[147] Third, while remote sensing data can be useful, it must be accompanied by ground truthing. In fact, EPA's peer reviewer, Dr. Brian Wardlow, concisely said "any supporting evidence whether it is ground truth observations, reports, and/or high resolution imagery to highlight potential errors either regionally or thematically would be helpful in understanding the possible uncertainty they could introduce into the GHG emission estimates and change projections."[148]

5. <u>Cumulative Demand Shocks Overestimates ILUC</u>

Based on our review of the modeling employed for the Proposed Rule, CARD used six shocks analyses according to CARD's Technical Report.[149] All the analyzed scenarios do not isolate the biofuels shocks, considering the shock on domestic production (for both biodiesel and ethanol) combined with a shock on the imported ethanol. This analysis leads to significant distortions on national and international land use changes impacts by overestimating the ILUC outside the United States. The first "international" ILUC effect is due to the increasing demand on corn-based ethanol and/or biodiesel from soybeans in the U.S.. This, in turn, leads to lower U.S. international supply of these products, which are compensated by increasing production in other countries (e.g., Brazil). This effect precedes any higher levels of U.S. imported ethanol demand and, thus, exacerbating the individual ILUC of foreign produced biofuel feedstock.

For the Brazilian specific case, since the country is an important international player in all analyzed feedstocks (i.e., corn, soybeans and sugarcane), and as evidenced by the model results responding to the demand shocks in producing all of these feedstocks, the cumulative impact of the demand shocks exponentially penalized Brazilian produced feedstocks.

In the Final Rule, we suggest the shocks be isolated in two aspects: First, in terms of U.S. production and imported shocks; and, also isolating the shock for each type of biofuels (ethanol and biodiesel). Only by analyzing this independent manner would it be possible to isolate the ILUC effects of a specific biofuel pathway in the RFS2.

6. <u>Price Responses from Supplier Countries</u>

Basic economic theory shows that an increase on the price of a commodity will induce an increase in the production of that commodity. However, countries respond differently to these price signals due to the combination of two basic factors: (a) a country's international competitiveness and (b) its land availability. In analyzing response to price signals, these factors should be combined in order to have coherence with the analysis of each country prices responses. For example, it is known that Argentina is highly competitive in some agricultural products in terms of costs, yields and so on, but it does not have enough land availability to support demand shocks. On the other hand, Brazil is also highly competitive *and* has

[147] Remarks at EPA's Renewable Fuel Standard's Public Hearing, EPA/OTAQ. (2009) (Testimony of Steffen Mueller and Ken Copenhaver, University of Illinois), June 11, 2009. See Document ID: EPA-HQ-OAR-2005-0161-1017.
[148] See page 87 (G6) at http://www.epa.gov/otaq/renewablefuels/rfs2-peer-review-land-use.pdf
[149] See ID: EPA-HQ-OAR-2005-0161.

considerable land available for agricultural expansion, from both the legal conversion of natural vegetation and the intensification of cattle production. With this in mind, any expansion in Brazilian agriculture should not have any significant leakage effect. A simple review what happened in the past years in Brazilian agriculture would illustrate the multidimensional dynamics of agricultural expansion in Brazil: expansion of second crops production, intensification of pasture areas and displacement of natural vegetation. Given that the models used in the EPA ILUC analysis do not consider land availability for each country, the results may not be consistent in terms of ILUC and of leakage effects among countries. We urge EPA to evaluate this issue prior to the Final Rule.

7. Shift of Land Use Patterns in Brazil due to Public Policies

EPA requested comments on the extent to which different government policies that shift land use patterns should be incorporated into the future land use change calculations and the best methodology for taking into account these changes.[150] We strongly urge EPA to incorporate these policy changes into its modeling. Brazil is at a critical juncture in terms of environmental public policies and their enforcement. Both governmental actions and private sector initiatives – agreements with governments and NGOs – are flourishing and are likely to be even more powerful in the future. Some significant legislations and agreements have already been mentioned earlier in our comments, such as the drop in Amazon deforestation, the sugarcane agro-ecological zoning, the sugarcane burning phase-out and the Brazilian Climate Alliance. It is also worth to mention the on-going discussions regarding the proposal of law for environmental crimes, which will set more severe penalties for those not complying with environmental legislations. All these policy changes and initiatives will change the pattern of land use change in Brazil. Considering that economic models reproduce the pattern observed in the past, it is imperative that the Final Rule seeks to address these likely future changes in various policy scenarios for land use change in Brazil.

8. Sugarcane Carbon Uptake is Underestimated

EPA's analysis uses the IPCC default value for annual cropland C stock, which is 5 Mt C/ha. However, as previously explained in Section I.A., sugarcane is a semi-perennial tropical crop that accumulates significant higher amounts of biomass above ground than other annual crops. Considering that IPCC recommends using its default values *only when* there is no other local estimate, we strongly suggest that the lifecycle analysis adopts the value of 17 Mg C/ha for sugarcane carbon uptake, as suggested in the BLUM. This value more accurately reflects the sugarcane biomass, which in turn can represent a carbon uptake when converting grassland to sugarcane.[151]

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[150] See 74 Fed. Reg. at 25032.
[151] 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).

IV. COMPLIANCE MECHANISMS REQUIRE REVIEW & RECONSIDERATION

A. PROPOSED RULE APPEARS TO BE WTO-INCONSISTENT

We believe that EPA's proposed approach to implementing the new RIN system, implicates several World Trade Organization (WTO) violations. We urge EPA to reconsider the proposed system to avoid such concerns. Specifically, the proposed RIN system described in the proposed RFS2 are inconsistent with the United States' international legal obligations under the WTO Agreement in six distinct ways. These six measures can be grouped in three categories of measures:

- Additional "enforcement-related" requirements that are levied *exclusively* on foreign renewable fuel producers (RFPs) and renewable fuel importers (RFIs), specifically the requirements to: (1) physically segregate fuel; (2) ensure third-party certification and comparison; (3) comply with an up-front bond-posting requirement; and (4) satisfy additional annual attest engagement requirements;[152]
- (5) The exemption of domestic small-batch RFPs from all recordkeeping, reporting and attest engagement requirements; and,[153]
- (6) The differential treatment of domestic and foreign RFPs in connection with documentation requirements for implementing the land use restrictions.[154]

Each single one of these six measures independently constitutes an unjustified discrimination of foreign renewable fuel and is thus in violation of Articles 2.1 and 2.2 of the Agreement on Technical Barriers to Trade (*TBT Agreement*), as well as Article III:4 of the General Agreement on Tariffs and Trade (*GATT*). In addition, all measures identified, except measure (5), the small-batch waiver for domestic RFPs, are in contravention of Article XI:1 *GATT*.

Under WTO precedent, a violation arises when *any* of these measures fulfills *one of three* conditions: (i) that it affords "less favorable" treatment to foreign renewable fuel than to "like" domestic renewable fuel (violation of Article 2.1 *TBT* and III:4 *GATT*); (ii) that it is a measure "more trade-restrictive than necessary to fulfill a legitimate objective" and thus creates an "unnecessary obstacle to international trade" (violation of Article 2.2 *TBT*); or (iii) that it constitutes a "restriction" "on the importation" of foreign renewable fuel.

Measures (1) through (4), the allegedly "enforcement-related" provisions, each constitute an unjustified discrimination of foreign renewable fuel in violation of Articles 2.1 and 2.2 of the *TBT*, and Articles III:4, and XI:1 of the *GATT*. Individually or in combination, these proposed requirements will effectively block exports of renewable fuel from Brazil and elsewhere by imposing substantial administrative impediments and prohibitive costs on foreign RFPs. By

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[152] § 80.1466 (74 FR 25138-25141).
[153] *See* § 80.1454 (74 FR, 25132).
[154] *See* 74 FR, 24941 ("We seek comment on whether and to what extent the approaches for ensuring compliance with the EISA's land restrictions by foreign renewable fuel producers could or should differ from the proposed approach for domestic renewable fuel producers … we believe it may be appropriate to require foreign renewable fuel producers to use an alternative method of demonstrating compliance with these requirements.").

contrast, less trade-restrictive alternatives such as certified statements coupled with certain civil prosecution, liability and sovereign immunity commitments by foreign RFPs could equally achieve EPA's goal of ensuring that foreign RFPs meet RIN requirements. At the very least, EPA should grant equal treatment to foreign RFPs originating in countries where comparable standards to the RFS2 prevail.

Measure (5), the proposed exemption of small-batch U.S. RFPs discriminates against foreign RFPs in general, and against similarly positioned small foreign producers in particular, thus violating *TBT* Articles 2.1 and 2.2, as well as Article III:4 of the *GATT*. EPA could eliminate this WTO-inconsistency by extending the waiver to similar-sized small-batch foreign producers.

Finally, any less favorable treatment of foreign RFPs in connection with documentation requirements concerning land use restrictions and handling of feedstocks (measure (6)) is in contravention of *TBT* Articles 2.1 and 2.2, as well as Articles III:4, and XI:1 of the *GATT*. A WTO-consistent alternative would involve applying the same set of requirements for domestic and international producers of renewable fuel. Alternatively, verification on land use and feedstock origin by government officials of the exporting country would suffice to achieve the same objective.

These measures, taken individually or in combination, are apt to completely block exports of renewable fuel, because they impose substantial administrative impediments and prohibitive costs on foreign RFPs, while affording an advantage to domestic producers. As is well known, and as two Panels in the *US – Upland Cotton* case stated,[155] in a highly commoditized market such as that for transportation fuel, small differences in costs (and thus prices) can have substantial volume effects. As EPA's Proposed Rule recognizes,[156] the ethanol market is already highly distorted due to various subsidies and trade protections.[157] Clearly EPA should seek to minimize, not exacerbate these trade barriers.

UNICA respectfully urges EPA to address these issues in finalizing the RFS2 to avoid any WTO violations. Further, beyond mere WTO ramifications, these unfair restrictions against foreign producers risk EPA's ability to achieve the ambitious volume goals mandated EISA due to the significant obstruction of foreign renewable fuel imports. Billions of gallons of imported renewable fuel, which would otherwise help obligated parties comply with EISA's ambitious renewable volume obligations, may be foregone unless these issues are addressed.

[155] Panel Report, *U.S. – Upland Cotton*, para. 7.1330; Panel Report, *U.S. – Upland Cotton (21.5)*, para. 10.50.
[156] 74 Fed. Reg. at 24917, 24997-8, 25079-80, and 25086.
[157] D. Koplow, Biofuels—At What Cost? Government Support for Ethanol and Biodiesel in the United States: 2007 Update (International Institute of Sustainable Development, Geneva, 2007); www.globalsubsidies.org/files/assets/Brochure_-_US_Update.pdf.

B. TECHNICAL COMPLIANCE CONCERNS

1. **Renewable Biomass Verification**

EISA's definition of "renewable biomass" creates a requirement for biofuel producers to verify that the source of their feedstock meets the requirements. Recognizing the logistical and pragmatic challenges in requiring verification of numerous requirements for widely divergent feedstocks and practices, the Proposed Rule requests comments on alternative methods to verify that this requirement has been satisfied.[158]

As noted earlier, in the case of sugarcane, we believe that the nature in which the feedstock must be produced facilitates compliance. Sugarcane must be grown in the vicinity of the mill where the feedstock will be processed. Because the sugars in cane stalks naturally begin to ferment into acids and alcohols as soon as the crop is harvested, sugarcane farming is by definition located next to the sugarcane processing. Once harvested, sugarcane is processed on average within less than 12 hours in Brazil. A sugarcane mill in Brazil receives its feedstock from an average distance of 15 miles away.[159] Also, this requirement by "Mother Nature" means that sugarcane mills tend to have long-term, exclusive sugarcane suppliers.[160] Most mills grow their own sugarcane or harvest it from leased lands, meaning that only about one quarter of all sugarcane in Brazil arrives at any given mill from an established third-party supplier.[161] In sum, to identify the origin of the feedstock, one needs only to identify the mill, as its feedstock must come from nearby areas.

UNICA would be pleased to work on established agreed-upon protocols for verification, similar to what was done with the Sustainable Ethanol Initiative with Sweden.[162] As noted earlier, this verification process in Brazil can be simplified by the use of remote sensing tools such as the public satellite imagery database for sugarcane areas available at the Brazilian Space Agency's website, http://www.dsr.inpe.br/canasat/. We also note here the proposal advocated by POET on July 21 concerning the establishment of a Renewable Biomass Allowance for biofuel producers[163] and believe that it may present a reasonable solution. Alternatively, given that nearly every mill in Brazil today must renew its operating license every two years with state authorities, we recommend EPA consider using this regulatory process, which requires mills to identify the source of their feedstock, with not only via traditional environmental impact

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[158] 74 Fed. Reg. at 24939-41
[159] See Chapter 4 in Zuurbier, Peter, and Jos Van de Vooren, eds. *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment*. Wageningen, The Netherlands: Wageningen Academic, 2008
[160] See ORPLANA (Organização dos Plantadores de Cana da Região Centro-Sul do Brasil), available at http://www.orplana.com.br/
[161] *Manual de Instruções*. Tech. CONSECANA (Conselho dos Produtores de Cana-de-Açúcar, Açúcar e Álcool do Estado de São Paulo), 2006. Web. 1 Sept. 2009. <http://www.orplana.com.br/manual_2006.pdf>
[162] http://www.sustainableethanolinitiative.com/default.asp?id=1062
[163] Whiteman, Bob. "Comment submitted by Bob Whiteman, Chief Financial Officers, POET Ethanol Products LLC." Letter to Environmental Protection Agency, Docket EPA-HQ-OAR-2005-0161. 21 July 2009. *Regulations.gov*. EPA Docket, Web. 1 Sept. 2009. <http://www.regulations.gov/>.

assessments but also thought the use of independent engineering audits, as part of its compliance mechanisms.

For the reasons stated above, and given the clear WTO-inconsistency of some of the aspects of the Proposed Rule, there is no need to establish additional requirements for the enforcement of the renewable biomass provision in EISA.

2. Registration of Facilities

The Proposed Rule establishes an "expanded" facility registration process for all renewable fuel producers, including those producing abroad.[164] While the requirements, which may include providing information about feedstocks, facilities, and products, as well as submitting an on-site independent engineering review of their facilities, appear reasonable two areas require greater clarification in the Final Rule. First, EPA should permit the required independent engineering review to be conducted by an independent third party who is based in — and licensed by — foreign countries. In the case of Brazil, there is an active and highly respected professional engineering community that undoubtedly meets comparable U.S. standards.[165] In fact, Brazil hosted the "World Engineers Convention" annual meeting in December 2008.[166] Second, EPA should facilitate facility registration by allowing the registration of mills by holding companies or cooperatives. In Brazil, one entity may oversee various mills either via a holding company or through a cooperative. A streamlined registration process that allows for one entity to register all of its mills together would greatly facilitate compliance and lower transactional costs.

3. Segregation & Dehydration

The Proposed Rule prohibits the commingling of similar foreign-produced renewable fuel until such time it enters the U.S. market.[167] In addition to the trade law concerns listed above, this burdensome requirement would generate additional costs for exports and, ultimately, consumers.

Brazil has nearly 400 mills producing hydrous and anhydrous ethanol, all of it un-denatured, which is distributed domestically and internationally via a complex network of truck, rail, pipelines and ships. To segregate the product at the level proposed by EPA, while technically feasible, would be prohibitively expensive. In addition, the Proposed Rule's requirements for segregation appear also to penalize renewable fuel processed in the Caribbean, as permitted (if not, encouraged) under U.S. trade laws. EPA recognizes that the "most likely route is through the Caribbean Basin Initiative [since] Brazilian [sugarcane] ethanol entering the U.S. through the

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[164] See 74 Fed. Reg. at 24943
[165] Brazil is a founding member World Federation of Engineering Organizations (WFEO) at http://wfeo.org/ as well as Pan American Federation of Engineering Associations (UPADI) at http://www.upadi.org.br/. At the national level, see Brazilian Federation of Engineering Organizations (FEBRAE) at http://www.febrae.org.br/ and Federal Council of Engineering (CONFEA) at http://www.confea.org.br/ for more information.
[166] See "Brasil vai sediar convenção mundial de engenheiros." *Valor Economico* [Sao Paulo, SP, Brazil] 11 Dec. 2006.
[167] See 74 Fed. Reg. at 24941.

CBI countries is not currently subject to the 54 cent imported ethanol tariff."[168] Yet, despite this obvious fact, the Proposed Rule's RIN system may prohibit the processing of Brazilian ethanol in the Caribbean by requiring an unwarranted and burdensome level of fuel segregation.

We recommend that EPA reconsider its approach on segregation and follow the example set by the European Union in the Renewable Energy Sources Directive[169] by considering a mass balance approach, whereby it would compare volumes of ethanol produced at registered mills in Brazil with volumes of ethanol exported to volumes of ethanol imported into the United States. Such accounting method is easily achieved with readily available data from the U.S. and Brazilian trade authorities.[170] In fact, we understand the U.S. Internal Revenue Service (IRS) is working with various U.S. agencies to harmonize import, production, and distribution codes in order to better track fuels (including ethanol) to enforce excise taxes. Perhaps EPA should explore how this IRS effort could serve EPA's compliance requirements under EISA.

4. <u>Denaturant & Point of RIN Generation</u>

Given that EPA takes the view that renewable fuel ethanol requires the addition of a denaturant,[171] and that in case of the sugarcane ethanol pathway the denaturant is nearly always added at the U.S. port of entry,[172] the Final Rule should clarify that importers, not foreign producers, should generate the RINs under RFS2 as has been the case in RFS1. The requirement for adding denaturant, which ironically requires the addition of a *non*-renewable fuel such as gasoline, is unique to the United States[173] and, consequently, one that shifts the point of RIN generation to the port of entry in the case of imported ethanol.[174]

V. <u>CONCLUSIONS</u>

UNICA supports EPA's proposed RFS2 rulemaking and believes EPA should finalize RFS2 at the earliest opportunity but, as evidenced by our detailed comments, respectfully requests careful review and reconsideration on various aspects that would improve the implementation of the RFS2 Proposed Rule and achieve the energy security and greenhouse gas reduction goals sought by the Energy Security and Independence Act of 2007 (EISA).

In the final analysis, we believe that EPA must take in consideration the abundance of scientifically-credible evidence that supports the determination that Brazilian sugarcane

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[168] See 74 Fed. Reg. at 24997
[169] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. Official Journal L 140 of 5 June 2009, page 16
[170] See U.S. International Trade Commissions (ITC) and Brazilian Ministry of Trade (MDIC).
[171] See 74 Feg. Reg. 25114 and 27 CFR parts 20-21.
[172] According to the U.S. International Trade Commission (ITC), which provided UNICA with data from 1996-2009, only about eight percent of all imported ethanol arrived at the U.S. port of entry "denatured." Of those, nearly all of it came from Canada and Trinidad & Tobago. For further information, contact Mr. Douglas Newman, International Trade Analyst, at the U.S. ITC.
[173] Ethanol in Brazil, either hydrous or anhydrous, does not contain *any* denaturant.
[174] See http://www.ttb.gov/industrial/alcoholfuel_bg.shtml

ethanol surpasses the advanced bioufel thresholds in the Proposed Rule. Moreover, EPA should finalize the rule at the earliest opportunity while improving upon a few key issues in a timely way. Among these issues, EPA should revise its technical lifecycle analysis, which understates the GHG benefits of sugarcane as a renewable feedstock, as well as ensure that its compliance mechanisms are consistent with U.S. international trade obligations, particularly including those related to the WTO.

As produced in Brazil, sugarcane is an environmentally sound, low carbon, renewable feedstock that meets the stated goals of the RFS2. Based on the conservative results of the BLUM for the "indirect" emissions[175] and the required emission credits from bioelectricity,[176] the revised results for the sugarcane ethanol pathway should be revised to 82 percent and 73 percent for 100 year with a 2% discount rate and 30 years with no discount rate, respectively.

We remain at your disposal to answer any questions or concerns EPA may have and look forward to helping meet the energy security and greenhouse gas reduction targets set by the Energy Security and Independence Act of 2007.

Respectfully Submitted,

Joel Velasco
Chief Representative - North America

[175] See page 30.
[176] See page 28.

EXHIBIT B

-OAR-2009-0211

UNICA

BRAZILIAN SUGARCANE INDUSTRY ASSOCIATION

July 20, 2009

VIA ELECTRONIC MAIL

JUL 20 2009

Environmental Protection Agency
Air and Radiation Docket and Information Center
Mailcode: 6102T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Submission of Comments
Clean Air Act Waiver to Increase the Allowable
Ethanol Content of Gasoline to 15 Percent
Docket EPA-HQ-OAR-2009-0211

To Whom It May Concern:

The Brazilian Sugarcane Industry Association (UNICA) welcomes the opportunity to provide specific comments to the U.S. Environmental Protection Agency (EPA) in support of the request for a Clean Air Act waiver to increase the allowable ethanol content of gasoline to 15 percent (Docket ID No. EPA-HQ-OAR-2009-0211).

As the largest representative organization of the Brazilian ethanol industry, our extensive experience with low, medium and high ethanol content blends is highly relevant to EPA consideration of approving the use of higher than 10% ethanol blends in U.S. gasoline. Our comments in this letter are structured as follows: (I) Introduction of UNICA's expertise with ethanol blends; (II) Brief review of the Brazilian experience with ethanol-gasoline blends; (III) Key technical aspects in support of the waiver application; and, (IV) Conclusion.

In short, UNICA respectfully recommends that EPA increase the allowable ethanol content of gasoline to 15 percent (E15) or consider an alternative blend higher than 10 percent. As described below, nearly a century of Brazilian experience with ethanol blended fuels at 15 percent and higher demonstrates that such fuels can lead to significant environmental and greenhouse gas benefits without environmental concerns or technology modifications that differ from those of E10. Thus, UNICA submits the comments below to reinforce that EPA can raise the allowable ethanol content to achieve its goals of realizing technologically feasible, cost efficient improvements that lead to real environmental benefits.

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I. UNICA'S EXPERTISE IN ETHANOL BLENDS

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 128 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.

Last year, Brazil produced over 31 million tons of sugar and about 27.5 billion liters (7.3 billion gallons) of sugarcane ethanol. In addition, the mills generate their own power from the sugarcane feedstock. Official government data indicates that sugarcane mills produced approximately 16,000 GWh of electricity (corresponding to about 3% of the country's annual electricity demand) last year.

As a result of Brazil's innovative use of ethanol in transportation and biomass for cogeneration, sugarcane is the leading source of renewable energy in the nation, representing 16% of the country's total energy needs according to official government data. Our industry is expanding existing production of ethanol-derived renewable plastics and, with the help of innovative U.S.-based companies, soon will offer bio-based hydrocarbons that can replace carbon-intensive fossil fuels. Partnerships and close relations between the sugarcane sector and multinational companies has been extensive and involves a variety of services and goods such as cellulosic ethanol research; supply of agricultural technology, products and machinery; process automation; cogeneration equipment; auto-parts; motor vehicles; ethanol production; and development of bio-plastics and trading.

II. REVIEW OF BRAZILIAN EXPERIENCE WITH ETHANOL-GASOLINE BLENDS

This section of our comments reviews the Brazilian experience with ethanol-gasoline blends both from a policy as well as from a technical aspect. Each section will begin with a summary, followed by a more detailed analysis.

A. Evolving Policy that Increased Ethanol Blends to 25% in Brazilian Gasoline

Brazil's successful experience with ethanol-blends in gasoline goes back to the early 1900s. During our century of experience with ethanol blends and a steady path of incremental changes, all vehicles and engines in Brazil — on and off road, as well as small engines — that rely on gasoline fuels operate with ethanol blends up to 25 percent. There is no "pure" gasoline available for sale in Brazil today. Throughout these many changes in ethanol's blend content, there were very few incidents where the existing fleet had to undergo engine re-tuning or recalibration or where there were noticeable negative effects on emission control systems over the useful life of the engine.[1]

[1] See "Attachment 1" for a detailed chronology of the various ethanol blends approved for gasoline in Brazil, both national and at a regional level.

In 1929, the sugarcane industry in Brazil was seriously affected by start of the Great Depression. In addition to the economic crisis looming, which had suppressed sugar demand, the sugarcane crop in 1929 was very large, further depressing sugar prices. An answer to this dual-problem – low sugar demand, high cane crop – was urgently needed.

In this 1920s figure, the Brazilian Agriculture Ministry is running a vehicle with ethanol-blended fuel.

Based on previous experiments in Brazil and elsewhere blending ethanol to gasoline, it was clear then – as it is today – that ethanol-gasoline blends work well with existing spark-ignition engines.[2] With this experience in hand, producing ethanol from surplus sugarcane and blending the renewable fuel with gasoline became a practical way to balance the sugar market and create an alternative product for the sugarcane industry and an alternative source for necessary energy and fuels. The government and industry acted quickly, and in 1931 Federal Decree Nº 197.717 required gasoline to contain a minimum volume of 5% ethanol (E5). The government also ordered that its own vehicle fleet use E10 in order to demonstrate the feasibility of higher ethanol content blends and evaluate ethanol as a fuel extender since all gasoline consumed in Brazil was imported.

During the next decade, various efforts were undertaken to increase the use of ethanol. In 1933, an ethanol oversupply in Northeastern States led to ethanol-gasoline blends containing 40% ethanol (E40). In 1938, Federal decree Nº 737 extended the 5% ethanol blend mandate to the gasoline produced domestically by the newborn oil refining industry. The following year, approximately 38 million liters of ethanol (10 million gallons) was blended into gasoline.

As World War II complicated Brazil's ability to import petroleum products, due partly to the submarine threats to oil tankers in the Atlantic, only a limited supply of gasoline was available for Brazilian vehicles. As with many other countries, Brazil had to implement fuel rationing to avoid the collapse of the domestic transportation system, critical for a continental country such as Brazil. The government again turned to the sugarcane industry for assistance in what was then considered emergency measures. The industry responded quickly to meet the demand left by gasoline and, by 1944, vehicles in Brazil's largest city, São Paulo, were running with blends of up to 85% ethanol to gasoline.[3]

At the end of the war, the recovery of the sugar prices and return of affordable and accessible oil undermined the supply and demand of ethanol fuel. Despite the lower economic and energy-related importance of blends in this era, however, such blended fuels continued to be

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[2] Starkman, E., H. Newhall, and R. Sutton. *Comparative Performance of Alcohol and Hydrocarbon Fuels.* Tech. University of California: SAE International, 1964. Print. Ser. 640649.

[3] Cytrynowicz, Roney. *Guerra sem guerra a mobilização e o cotidiano em São Paulo durante a Segunda Guerra Mundial.* São Paulo, SP, Brasil: Geração Editorial, Ed USP, 2000. Print

used. According to available data ethanol percentage varied from 0.3% in 1964 to 2.9% in 1973 peaking at 6.2% in 1967.[4]

Up until the 1950s, Brazil did not produce cars but assembled them locally or imported the vehicle ready, mainly from the United States.[5] During that decade, Brazil started to produce motor vehicles.[6] Although these locally-made vehicles were not engineered or tuned to operate on ethanol blends, consumers continued to use a variety of ethanol-gasoline blends. Reports do not indicate that blends negatively affected vehicle reliability or caused other performance problems. This can be explained by the fact that ethanol already complied with certain quality requirements and the existing engine technology was sufficiently robust and did not require very tight engineering tolerances. Also, engines were tuned for high power, thus operated on rich air-fuel mixtures (excess fuel in the air-fuel mixture). The leaning effect of ethanol on the mixture did not impair significantly both drivability and performance. Obviously consumer satisfaction, which can be readily measured, was decisive in determining the use of the ethanol blends. If field problems were an issue they would have become public and limited further sale and use of ethanol blends, something that has not been reported.

In 1975, following the first oil shock, which seriously affected Brazilian economy, the federal government launched the National Ethanol Program (ProAlcool), an ambitious initiative to reduce the impacts of skyrocketing oil prices on the balance of payments and help the sugarcane industry that was struggling with low sugar prices. One of the key elements of ProAlcool was the extensive use of ethanol-gasoline blends. Previous experience had shown that promoting the use of blends on a nationwide scale would be a rapid and cost-effective strategy to reduce consumption of imported oil, which amounted to 80% of total consumption at the time. Production of ethanol increased rapidly and logistics were quickly developed to supply ethanol-gasoline blends all over the country. In 1977, the average ethanol content in gasoline was 4.5%.

In 1978, with growing availability of ethanol in the marketplace, E15 started to be used and in 1979 E15 became the official blend. Following the second oil shock, the government called on both the sugarcane and the automotive industry to further expand ethanol use through not only higher blends but also through hydrous ethanol (E100) in specially adapted vehicles. The development of ethanol-dedicated vehicles that would be able to operate on 100% ethanol (E100) remains one of the most well known elements of ProAlcool. By the end of 1979 the first E100 automobiles reached the market.

By the end of 1979 the first E100 automobiles reached the market. Producing E100 vehicles in Brazil was a matter of survival for the local motor industry, which was facing a declining gasoline-dependent vehicle market during a period of steep increase in oil prices. Motivated by a sense of national independence from expensive petroleum and derivatives, by sales

[4] Leao, Regina M. *Alcool, Energia Verde*. São Paulo, SP, Brasil: IQUAL Editora, 2002. Print.
[5] In 1925, GM established a plant in Brazil but it was not until the 1950s that it produced a 100% locally-made vehicle. See http://wiki.gmnext.com/wiki/index.php/GM_do_Brasil_Milestones:_1925_-_1929.
[6] Mendes Thame, Antonio Carlos, ed. *The History of the Alcohol Car (Translated)*. São Paulo, SP, Brasil: IQUAL Editora, 2003.

incentives, and faced with very high gasoline prices, Brazilian consumers opted to buy ethanol-dedicated vehicles.[7]

In 1981, Brazil increased the blend of ethanol in gasoline from 15% to 20%, even though at the time most consumers were opting to buy ethanol-dedicated vehicles. Although ordinary gasoline engines worked well with blends up to E15 without significant effects on materials, parts, fuel consumption, performance and drivability, the prospect of higher ethanol content blends in the immediate future induced some simple but effective engineering measures to optimize new vehicles to future blends. Recognizing this shift, already in the late 1970s the automakers established in Brazil[8] began selling new vehicles with the following modifications: recalibrated carburetor settings, optimized spark-timing, corrosion resistant coatings and materials in the wet parts of the fuel supply system and neoprene fuel pump diaphragms.[9]

In 1985 the ethanol content in the blend was increased to 22% (E22) and in 1998 to 24% (E24). At the same time, the use of hydrous ethanol (E100) in the ethanol-dedicated vehicles began to slow as oil prices fell through much of the 1990s.[10] In fact, while in the mid-1980s nearly all cars sold in Brazil were ethanol-dedicated, by the mid-1990s Brazilian consumers were opting to buy "regular" cars again, that would not be able to use E100 but instead up to E25.[11]

In an effort to improve Brazil's ethanol-blending program, the federal government approved in 2002 new rules that established that ethanol content in gasoline fuels should be within the range of 20% to 25% (E20-25).[12] Regulations established that the actual ethanol content be determined by a Inter-Ministerial Sugar and Ethanol Council (CIMA, in its Portuguese acronym) based on supply-demand analysis of the sugar and ethanol market. CIMA has set the current blend at its maximum, E25. The use of E25 has been complemented by a strong and growing E100 demand resulting from the success of the flex fuel vehicle technology, which came to the Brazilian market in 2003 and is already surpassing 8 million vehicles.[13] (See Figures 1 and 2 below.)

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[7] Weidenmier, Marc, Joseph Davis, and Roger Aliaga-Diaz. "Is Sugar Sweeter at the Pump? The Macroeconomic Impact of Brazil's Alternative Energy Program." National Bureau of Economic Research. Oct. 2008. 20 July 2009 http://www.nber.org/papers/w14362.

[8] It is important to note that car imports were practically prohibited for almost 30 years until 1989. During this period, only a few manufacturers (namely, Fiat, Ford, General Motors, Volkswagen and some small local companies) had access to the Brazilian domestic market.

[9] Szwarc, Alfred and Branco, G.M, "Automotive Use of Alcohol in Brazil and Air Pollution Related Aspects," SAE technical paper 850390, *International Congress & Exposition*, Detroit, MI, February 1985.

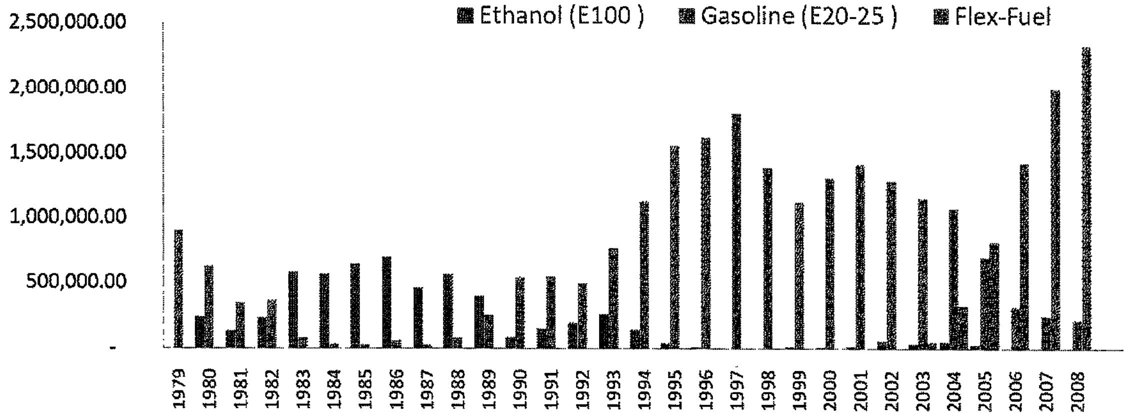
[10] For more information on the Brazilian government support for ethanol fuel, see Dias de Moraes, Márcia Azanha Ferraz, and Luciano Rodrigues. Brazil National Alcohol Program. 2006. MS. University of Sao Paulo, Piracicaba, SP, Brazil. Online at http://www.scribd.com/doc/15700092/History-of-the-Brazilian-Ethanol-Program.

[11] For detailed data on car fleet, see annual reports of Brazilian Automakers Association (ANFAVEA), available online at http://www.anfavea.com.br/anuario.html.

[12] Due to the inherent characteristics of the blending process, a tolerance of ± 1% was allowed, making the accepted range 19-26%.

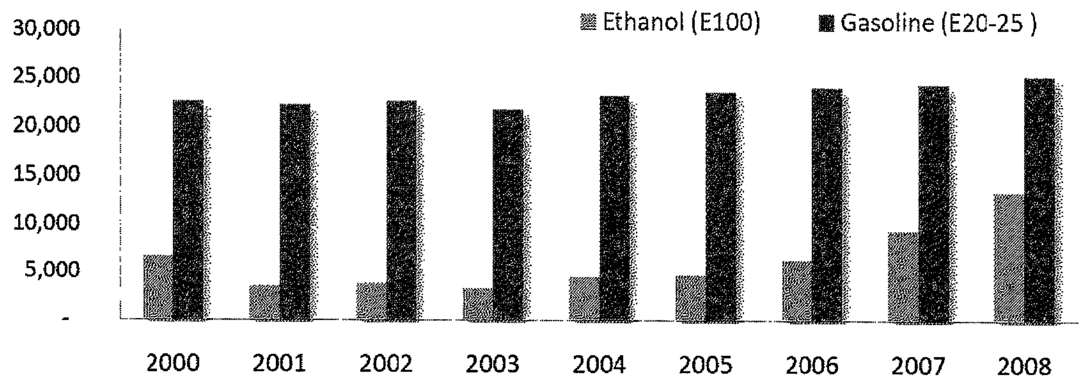
[13] Flex-Fuel Vehicles (FFVs) have been sold in Brazil since 2003. See Figure 1. There are over 8 million FFVs today in Brazil. During the first six month, 92% of new cars sold in Brazil are FFVs. It is estimated that these FFVs consume only hydrous ethanol (E100) nearly 80% of the time today and more than 50% of otto-cycle engine fuel in Brazil is sugarcane ethanol today. For more information on FFVs in Brazil, see Joseph, Henry. *New Advances in Flex-Fuel Technologies*. Ethanol Summit, Sao Paulo Brazil. Online at http://bit.ly/info/10A6MF

Figure 1: Annual Vehicle Sales per Engine Type in Brazil (Units)



Source: Brazilian National Oil, Gas & Biofuels Agency (ANP). Data for first half of 2009 shows that 92% of new cars sold are flex-fuel. There were 1.2 million flex-fuel vehicles registered in first half of 2009.

Figure 2: Ethanol (E100) vs. Ethanol-Blended Gasoline Consumption in Brazil (Million of Liters)



Source: Brazilian National Oil, Gas & Biofuels Agency (ANP)

B. Review of Scientific and Technical Aspects of Ethanol-Blends in Brazil

Ethanol-blended fuels provide a number of environmental benefits, including reducing emissions of conventional and greenhouse gas pollutants in vehicle exhaust. With the implementation of new motor vehicle emission control programs in Brazil, vehicles have been adjusted to comply with stricter environmental requirements.

Mixing ethanol to gasoline increases octane rating of the fuel and, consequently, allows the phase-out of toxic lead additives, which were fully phased out in 1989 in Brazil.[14] The

[14] Karpov, S. "Ethanol as a High-Octane, Environmentally Clean Component of Automotive Fuels." *Chemistry and Technology of Fuels and Oils* 43.5 (2007): 355-61. Print.

requirements for ethanol-blended gasoline also allowed petroleum refinery operations to decrease the content of aromatic hydrocarbons in the gasoline, a popular solution used to boost gasoline octane but environmentally undesirable due to the toxicity of the aromatic compounds. As a result, the highly-respected São Paulo State Environmental Protection Agency has long recognized the merits and benefits of extensive fuel ethanol usage in the São Paulo Metropolitan Region (SPMR), the largest urban area in South America that has a fleet of over 6 million vehicles.[15]

The benefit of ethanol's octane increase in blends — as well as the wide use of hydrous ethanol (E100) in flex-fuel vehicles[16] — has also allowed car manufacturers to increase engine compression ratios – from approximately 7.5:1 to up to circa 10.5:1 – thus promoting higher thermal efficiencies, which offset the lower energy content of ethanol.[17] As the result of the technological progress fuel economy, performance, drivability and overall reliability of modern gasoline vehicles optimized to E25 are equivalent or superior to ordinary gasoline vehicles operating with neat gasoline. Maintenance requirements are equivalent too with the benefit of lower carbon deposits in the engine due to ethanol's cleaning properties.

In addition to these benefits of ethanol blends, over the last twenty years, state-of-the-art technologies have been adopted by the automakers to attain the Brazilian emission limits, which have been strictly controlled since 1986.[18] New engine designs, electronic fuel injection, electronic ignition control, engine management, catalytic converters, exhaust gas recirculation, crankcase vapor recycling, evaporative emission control, turbocharging and on-board-diagnosis have all been customized to ethanol blends and incorporated to the new vehicles in Brazil. The table below summarizes the emission limits for light duty vehicles in Brazil.[19]

This year, Honda began selling a flex-fuel motorcycle and we expect other manufacturers to follow suit not just in motorcycles but also other engines due to consumer demand.[20]

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[15] See the Annual Air Quality Reports by São Paulo State Environmental Secretary's Environmental Technology Company (CETESB), available online at http://www.cetesb.sp.gov.br/Ar/publicacoes.asp from 2001 to present.

[16] Flex-fuel cars selling at record pace in Brazil. UNICA, 07 July 2009. Web. 17 July 2009. http://english.unica.com.br/

[17] Since 2003, when flex fuel cars were introduced in Brazil, there has been a steady evolution in flex engines, which are now being designed 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. For further information, see presentation by Dr. Henry Joseph, head of environmental committee of the Brazilian Automakers Association (ANFAVEA), available http://www.royalsoc.ac.uk/downloaddoc.asp?id=4248

[18] See Resolution Nº 18 in 1986 by CONAMA (National Environment Council) followed by additional regulatory requirements. Online at http://www.mma.gov.br/port/conama/res/res86/res1886.html

[19] Szwarc, Alfred. "Impacts of the Use of Etahnol in Vehicle Emissions in Urban Areas." *Sugar Cane's Energy*. São Paulo, SP, Brasil: Berlendis & Vertecchia, 2005. 80-85. Print.

[20] See http://bit.ly/xkvV4 for further information on Honda's Flex-Fuel 150cc motorcycles.

Exhaust Gas Emission Limits for Light-Duty Vehicles in Brazil

	HC g/km	NMHC g/km	CO g/km	NOx g/km	PM** g/km	R-CHO*** g/km	Phase-in Year	Phase -in %
Phase 1	2,1	-	24	2	-	-	1988	100
Phase 2	1,2	-	12	1,4	-	0,15	1992	100
Phase 3	0,3	-	2	0,6	0,05	0,03	1997	100
Phase 4	0,3*	0,16	2	0,25/0,6**	0,05	0,03	2005	40
Phase 4	0,3*	0,16	2	0,25/0,6**	0,05	0,03	2006	70/100****
Phase 4	0,3*	0,16	2	0,25/0,6**	0,05	0,03	2007	100
Phase 5	0,3*	0,05	2	0,12/0,25**	0,05	0,02	2009	100

Notes: 1) The U.S. Federal Test Procedure 75 is the official certification procedure; 2) The limit for evaporative emissions is 2.0 g/test and the certification procedure is the U.S. SHED test; 3) Cranckase emissions have to be nil; 4) Certification fuel is a E22 blend that complies to specifications set by the National Council of Oil, Natural Gas and Biofuels (ANP); 5) emission control minimum durability requirements are set to 80,000 km or five years use, whichever comes first; Other miscellaneous notes: (*) only CNG vehicles (**) only diesel vehicles (***) aldehydes (sum of acetaldehyde and formaldehyde) - only Otto cycle vehicles, except CNG vehicles; (****) only brand new models; 5) new emission limits to be phased-in by 2012 are being regulated

As noted earlier, it was not until the late 1980s when fully assembled vehicles were allowed to be imported into Brazil following decades of prohibition. Over the last several years, vehicles from almost all leading international brands have been used in Brazil.[21] Imported vehicles are adapted to use up ethanol-blended gasoline either by the manufacturer in the country of origin or by the importer. In general, this process requires ethanol-compatible materials in the fuel system and engine tune-up (basically fuel delivery and ignition timing) for a mid-range point, usually E22, which is the reference blend for engineering development and emissions testing in Brazil.[22] This customization has resulted in good drivability and performance, with fuel consumption comparable to gasoline operation. In all cases either the manufacturer or the import company has provided full warranty coverage for the vehicles. According to industry, government and specialized media sources these vehicles operate normally and present trouble-free operation in Brazil.[23]

[21] Here are the names of the known imported brands compatible with E25 in Brazil: Alfa Romeo, Audi, BMW, Citroen, Chana, Chevrolet, Chrysler, Dodge, Effa, Ferrari, Fiat Ford, Haffei, Honda, Hyundai, Jaguar, Jeep, Kia, Lada, Land Rover, Lexus, Lamborghini, Maserati, Mercedes Benz, Mini, Mitsubishi, Nissan, Peugeot, Porsche, Renault, Seat, Smart, Ssangyong, Subaru, Suzuki, Rolls Royce, Toyota, VW and Volvo.

[22] Recently, UNICA learned that a few imported models have been originally designed to use any ethanol blend up to 30% ethanol content (called by industry sources "soft flex fuel vehicles") and therefore do not need to be adapted to E20-E25. Although this information is of great interest to the Brazilian ethanol industry and consumers, no car manufacturer declared this publicly yet.

[23] For various reviews from a technical as well as consumer perspective of vehicle performance with ethanol-blended gasoline, see http://quatrorodas.abril.com.br/QR2/

III. KEY TECHNICAL ASPECTS IN SUPPORT OF THE WAIVER APPLICATION

This section of our comments provides scientific and technical comments in support of an increase of the allowable ethanol content of gasoline to 15 percent in the United States.

A. Studies on E10 Blends & Beyond

There are records of E10 use in the United States (and Europe)[24] since the 1920s when Standard Oil began adding ethanol to gasoline to increase octane and reduce engine knocking. However, it was only in late 1970s that E10 started to be used more widely.[25] Over the years the blend gained consumer acceptance and it is presently the most popular blend in the United States and around the world. Extensive experience with E10 demonstrates that it can be used effectively and safely with the existing fleet.[26]

Various studies throughout the world beyond just Brazil support the use of higher than 10% blends without engine recalibrations or vehicle modifications. Here we highlight studies in three additional separate nations: South Africa, The Netherlands, and Australia.

E15 in South Africa. Since the early 1980s South Africa has been using ethanol in the range of 8% ethanol (E8) to E15. In the late 1990's Sasol, a manufacturer of both gasoline and ethanol fuels, had a special interest to supplement the supply of gasoline with blends in the higher altitude regions of South Africa via pipeline. Considering that this represented a unique situation, the Company decided to assess and ensure the technical feasibility of the project. Sasol conducted a detailed test and evaluation program addressing all relevant aspects to the case, including pipeline transportation, retail site equipment, permeation rate of piping materials and vehicle performance and consumer satisfaction. The test program, which had the participation of oil companies, automakers, and marine equipment manufacturers showed that no major problems related to the use of the blends were identified. During the first six months of the blends mixture presence in the market, in the Highveld region which is home to about 40% of South Africa's automotive fleet, the amount of incidents that were fuel related accounted for only 0.009 % of vehicle breakdowns.[27]

E15 in The Netherlands. An interesting experience with E15 has been carried out almost unnoticed in the Netherlands since 2008. What differentiates this program from other E15 test programs is the use of *hydrous* ethanol instead of *anhydrous* ethanol that is the standard product for blending. The blend also contains a co-solvent to avoid phase separation and is

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[24] In Europe, ethanol was also used as an octane booster in the 1920s and 1930s when it was added to gasoline at levels ranging from 10% up to 33%. France, Germany and Britain were the leading users of fuel ethanol at that time. Germany, through the work of the Deutsche Landwirtschaftliche Gesellschaft in Berlin, helped pave the way for expanded use of ethanol in Europe during this period.

[25] Wagner, T., D. Gray, B. Zarah, and A. Kozinski. *Practicality of Alcohols as Motor Fuel*. Tech. no. 790429. Chicago, Illinois: Amoco Fuels, 1979. Print.

[26] Mills, G. A., and E. E. Ecklund. "Alcohols as Components of Transportation Fuels." *Annual Review of Energy* 12.Nov (1987): 47-80. Print.

[27] Van Der Merwe Douw G. et al, *Methodology of Introducing Sasol Fuel Alcohol as Gasoline Component in South Africa*, International Symposium on Alcohol Fuels, July 3 – 6, 2000 Stockholm, Sweden.

regarded by the company leading the program – HE Blends BV28 – a successful demonstration that hydrous E15 can be used. The blend, which is prepared using 85% of Euro 95 gasoline and 15% Brazilian standard hydrous ethanol, was officially launched on July 7, 2008 by the Dutch Minister of the Environment under the brand name hE15 BioSuper.[29] After conducting monitored field tests with a 2006 Volkswagen Golf 5 model, a 2008 Ford Mondeo and two-stroke and four-stroke motor scooters, the Company concluded "no vehicle operational differences between gasoline and hE15 were observed nor any mechanical problems were encountered. Emission testing by TNO and SGS showed low emission levels within European (Euro 4) emission standards on both fuels with generally lower hydrocarbons (HC) and carbon monoxide (CO) levels and higher nitrogen oxides level (although still within EU standards) on hE15."[30] The hydrous blend is already being sold to the general public and soon will be distributed by a network of 150 fuel stations in the Netherlands. Following the successful introduction of hE15 in the Dutch market, we understand that the EPA approved the hydrous E10, hydrous E20, hydrous E30 and hydrous E85 test program in the State of Louisiana, to be carried out until January 1, 2012.

E15 in Australia. In 1979 studies with E15 blends were conducted in Australia and included a 100 vehicle fleet trial at the time. The mixtures were prepared with anhydrous and hydrous (with 1% butanol as a co-solvent).[31] Although relatively extensive, these studies were not conclusive about the feasibility of E15. Moreover the Australian government lacked the political motivation to introduce ethanol in the market, which occurred only in 2003 in certain regions with only E10.

B. Established Environmental Benefits

There are clear benefits in the reduction of conventional pollution and greenhouse gases when ethanol blends are compared to gasoline.[32] Despite a few contentious issues such as effect on fuel volatility or on aldehyde emissions, which we address below, there is no doubt that benefits outweigh any potential disadvantages as discussed below.

After over thirty years of using ethanol-blended gasoline in large, nationwide scale in Brazil, we can affirm the following about the use of ethanol-blended gasoline:

- No unique environmental or safety risks regarding blending, transportation, storage and handling;
- Reduction of highly toxic aromatic hydrocarbons emissions;[33]

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[28] See http://www.heblends.com for more information.
[29] See http://www.best-europe.org/Pages/ContentPage.aspx?id=547.
[30] Keuken, H. at ali, *Hydrous Ethanol for Gasoline Blending*, 17th International Symposium on Alcohol Fuels, October 13-16 2008, Tiayuan, China.
[31] *Extended Field Trials of Ethanol Blends in Vehicles*. Tech. Australia: Hassal and Associates, 1994. Print.; *Enhanced Extension of Petrol with Aqueous Alcohol*, Tech. Australia: CSR Chemicals Ltd, NERDDC, Project 81/1432, Final Report. 1981. Print.
[32] Zuurbier, Peter, and Jos Van de Vooren, eds. *Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment*. Wageningen, The Netherlands: Wageningen Academic, 2008. Print.
[33] Mainly benzene, 1-3 butadiene, xylene and toluene. Actual reduction depends on vehicle and blend characteristics.

- "Leaner" combustion which reduces exhaust emissions, mainly carbon monoxide (CO) and hydrocarbons (HC) / Volatile Organic Compounds (VOC);[34]
- Reduced emissions of inhalable sub-micron particles;
- Lower sulfur content, reduced sulfur compound emissions and related negative environmental impacts such as formation of secondary sulfates and acid precipitations (reduced sulfur also prevents catalytic converter poisoning, which is known to lead to lower operational efficiency and therefore increased emissions);
- Is a cost-effective and environmentally friendly "octane enhancer";
- The solvent property of ethanol keeps the fuel system clean of deposits in the fuel system or combustion chamber that otherwise might be the source of increased emissions;
- Has a positive energy balance when considering the lifecycle to grow, harvest and process biomass to produce ethanol (in Brazil the energy ratio of renewable energy from ethanol to fossil energy consumed during the production phase is 9.3:1). As recognized by EPA in proposed RFS2 rule, blending sugar cane ethanol into gasoline in particular improves the energy balance of the fuel. This is of importance because the energy balance of gasoline is either negative or marginally positive; and
- Reduces carbon dioxide (CO_2) emissions significantly considering ethanol's lifecycle. Based on our long experience and analysis, if E15 were to be prepared with sugarcane ethanol from Brazil the average CO2 reduction would be in the order of 12-24%.

Thus, as indicated above, the nearly century-long Brazilian experience demonstrates that ethanol blends generally, and sugarcane based blends specifically, lead to significant environmental and greenhouse gas benefits over conventional fuels.

C. Limited Environmental Concerns

As demonstrated below, any environmental concerns associated with ethanol blended fuels are relatively slight, can be mitigated, or are unsubstantiated.

First, in the case of ethanol-blended fuels, there may be marginal inefficiencies in reducing NOx emissions. In fact, the enleanment of the fuel to air ratio may contribute to an increase in NOx emissions but the magnitude is generally low (1% to 10%.) NOx generation is highly dependent on engine and emission control characteristics as well as load and engine speed.[35]

Second, ethanol-blended fuels are ineffective in reducing aldehyde emissions. The partial oxidation of ethanol is a source of aldehydes, mainly acetaldehyde, which is less toxic and photo-chemically reactive than formaldehyde, a major aldehyde species characteristic of

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[34] Nakata, Koichi, and Shintaro Utsumi. *Powertrain & Fluid Systems Conference*. Proc. of The Effect of Ethanol Fuel on a Spark Ignition Engine, Http://www.sae.org/technical/papers/2006-01-3380, Toronto, Canada. N.p.: SAE International, 2006. Print.
[35] Szwarc, Alfred. "Impacts of the Use of Etahnol in Vehicle Emissions in Urban Areas." *Sugar Cane's Energy*. São Paulo, SP, Brasil: Berlendis & Vertecchia, 2005. 80-85. Print.

gasoline combustion.[36] At the same time, aldehyde emissions from E22 have been measured in Brazil and reach low levels. Typically, 2008 model-year Brazilian vehicles emit 2 mg/km (3.2 mgpg) aldehydes (formaldehyde + acetaldehyde), a concentration that is about 20% less than the strictest emission limit applied only to formaldehyde.[37] Since emission control systems that equip Brazilian vehicles are equivalent in emission control efficiency to those installed in U.S. cars, it is fair to conclude that E15 should not be a barrier to the attainment of the formaldehyde emission limit.

Finally, three other environmental concerns are often raised in the context of ethanol-blended gasoline. As described below, we believe these concerns are without merit. *First*, there has been media speculation that *durability of catalytic converters* could be lowered if E15 is used on a regular basis in vehicle engines. This is based on the reasoning that the enleanment of the air-fuel mixture increases the heat stress of the catalyst a phenomena that would over time result in faster degradation. UNICA consulted with manufacturers of catalytic converters used in Brazilian vehicles and they asserted that increasing the ethanol content from E10 to E15 should not be affect the catalytic converter's pollutant conversion efficiency or durability. This conclusion is also backed by recent research in the USA undertaken by the National Renewable Energy Laboratory (NREL).[38] According to NREL's work, which evaluated tailpipe emissions for 16 popular late-model vehicles on a drive cycle similar to real-world driving, regulated tailpipe emissions remained largely unaffected with E15 as compared to neat gasoline and E10. The report note that running the engine at wide open throttle conditions (WOT) increased catalyst temperatures by approximately 30 °C, which is a small temperature increase within the operating range and is not expected to deactivate the catalytic converter. More importantly, however when operating the engine at closed-loop operating conditions (most usual situation during normal driving), catalyst temperatures were cooler or unchanged with E15. Therefore, speculations about E15 causing significant heat stress on the catalytic converter seem quite unrealistic, if not exaggerated.

Second, critics of ethanol often point out the lower fuel economy (measured as miles per gallon), which is generally regarded as directly proportional to the fuel's energy content.[39] However, there are many other variables that affect the performance of a particular fuel in a particular engine, mainly engine design and calibration characteristics. Although ethanol contains approximately 33% less energy per unit volume than gasoline, for E15 the effect on fuel economy is small, usually in the range of zero to 3% (average fleet data) when compared to neat gasoline use in the same engine.

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[36] Tardif, Robert, Ling Liu, and Mark Raizenne. "Exhaled Ethanol and Acetaldehyde in Human Subjects Exposed to Low Levels of Ethanol." *Inhalation Toxicology* 16.4 (2004): 203-07. Print.
[37] Formaldehyde emission limits vary in the United States from 32 to 4 mgpm, depending on vehicle class and emission control requirements.
[38] Brian West, Keith Knoll, Wendy Clark, Ronald Graves, John Orban, Steve Przesmitzki, and Timothy Theiss (2008). "Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1". Oak Ridge National Laboratory and National Renewable Energy Laboratory. http://feerc.ornl.gov/publications/Int_blends_Rpt_1.pdf. NREL/TP-540-43543, ORNL/TM-2008/117.
[39] Shadis, William, and Peter McCallum. *Comparative Assessment of Current Gasohol Fuel Economy Data.* Tech. no. 800889. N.p.: Mueller Associates, Inc., 1980.

Third, ethanol-gasoline blends are frequently blamed for increased *fuel volatility*, therefore increasing evaporative emissions.[40] Although it is true that blending ethanol with gasoline increases volatility, as expressed usually in terms of the standard Reid Vapor Pressure (RVP) and Distillation Curve (DC) measurements, a fair evaluation of the case requires consideration of the following points that are generally overlooked:[41]

- RVP, which has been used as a popular parameter to evaluate ethanol-gasoline blends volatility, is a very limited indicator for this purpose because it is measured only at one temperature (37.8 ºC) and at an arbitrary air-to-liquid ratio of 4:1. Since fuel temperatures may vary widely as well as engine temperatures, a more precise evaluation requires an additional evaluation of the DC and other parameters such as the vapor-liquid ratio, at selected temperatures;
- Blend volatility varies as a function of base gasoline composition and gasoline types with lower concentration of light hydrocarbons will show a smaller volatility increase when blended with ethanol. The United States has already introduced the practice to Reformulated Gasoline in order to make it suitable for ethanol blending (RBOB and CARBOB gasoline blendstocks);
- Blend volatility varies as a function of ethanol concentration in the blend. For a particular gasoline there is a concentration of ethanol that results in a RVP peak (this peak may vary for different gasoline types but is generally within the region of 3% to 6% ethanol content). Once the peak is reached addition of more ethanol will reduce RVP. Therefore, increasing the blend to E15 may actually reduce RVP in comparison to E10. Moreover, depending on the gasoline blendstock characteristics the need to reduce gasoline volatility before blending could be reduced;
- Volatility is a rather complex issue because it affects vehicle performance, drivability, emissions and fuel consumption. In addition volatility requirements vary from one region to other and from summer to winter. Therefore limiting the use of ethanol-gasoline blends exclusively on the grounds of increased volatility without an in-depth analysis of the proposed use is certainly incorrect. For instance, regions that have cold weather may actually benefit from a higher volatility because it will facilitate cold starting of the engine, improve drivability, reduce emissions and increase fuel economy. Even when ambient temperatures are higher and fuel evaporative emissions increase there may be no negative environmental impact. It has been shown that despite of increased volatility the use of E10 did not result in higher smog formation potential and toxicity and carcinogenic risk actually decreased. The conclusion was achieved after

[40] Varde, K., A. Jones, A. Knutsen, D. Mertz, and P. Yu. "Exhaust emissions and energy release rates from a controlled spark ignition engine using ethanol blends." *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering* 221.8 (2007): 933-41.
[41] Johansson, Håkan, and Helge Schmidt. "Lack of legislation causes large problems with evaporative emissions." Proc. of 9th International Conference on Engines and Vehicles, Session: General Emissions, Naples, Italy. N.p.: n.p., 2009. N. pag. Print.

weighting the increase of evaporative organic compounds and the decrease of exhaust organic compounds.[42]

- Fuel evaporative emission control systems have been used in many countries for more than a decade and the substitution of carburetors by fuel injection systems some years ago has actually improved the emission control capability. Vehicles equipped with fuel injection systems and evaporative emission control, which are now the industry standard, are quite efficient in avoiding significant evaporative emissions. Taking Brazil as an example, fuel evaporative emission levels from 2008 model year vehicles equipped with activated carbon canisters and fueled with a 22%v/v ethanol-gasoline blend average an emission of 0,6 g/test (U.S SHED test procedure).[43] This emission represents only 30% of current limit of 2 g/test and is also adopted in many countries that have advanced emission control programs.
- Existing international experience shows that gasoline vehicles fueled with ethanol-gasoline blends have not been affected by vapor lock, an undesirable effect associated to excess vapor formation in the fuel supply system. Brazil and South Africa, countries that are subject to high ambient temperatures that exceed in some regions 40 ºC (104 ºF) during summer, have not registered vapor lock occurrences with E15 or higher ethanol content blends. Another example, although not at such high ambient temperatures, is the use of E10 at high altitude, in Colorado, a situation that also favors enhanced fuel vaporization, and has not been associated with vapor lock events.

IV. CONCLUSION

UNICA recommends that EPA increase the allowable ethanol content of gasoline to 15 percent (E15) or consider an alternative blend higher than 10 percent. Commercial use of ethanol blends in the United States has been largely based on the experience acquired with E10 and lower level ethanol content mixtures over several years. The Brazilian experience shows that preparation, storage, transportation and fuel dispensing requirements of E15 blends do not differ from those of E10. Material compatibility requirements and operational procedures are basically the same and should not represent any particular source of concern under normal conditions for E15 in the United States.

We hope these comments will contribute to improving EPA's understanding of the issues concerning the use of higher blends of ethanol in gasoline and remain at your disposal to answer any questions you or your colleagues may have.

Sincerely,

Joel Velasco
Chief Representative - North America

Alfred Szwarc
Emissions & Technology Advisor

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[42] Apace Research Ltd., *Intensive Field Trial of Ethanol/Petrol Blend in Vehicles*, ERDC Project 2511, December 1998
[43] See the 2008 Annual Air Quality Reports by CETESB, available online at http://www.cetesb.sp.gov.br/Ar/publicacoes.asp.

<u>ATTACHMENT 1</u>: Chronology of Regulation of the Ethanol-Blended Gasoline in Brazil

LEGAL MIX OF GASOLINE AND ETHANOL
CHRONOLOGY

Legal Device		Scope	Mixture		
Nº	Date of publication		Limit	%	Date of entry into force
Decree nº 19.717	20/02/31	Nationwide	0 < > 5%		01/07/31
Decree-Law nº 737	23/09/38		0 < > 5%		
Decree nº 20.169	01/07/31		0 < > 5%	2%	01/07/31
Decree nº 20.169	01/07/31		0 < > 5%	3%	01/08/31
Decree nº 20.169	01/07/31		0 < > 5%	4%	01/09/31
Decree nº 20.169	01/07/31		0 < > 5%	5%	01/10/31
Decree nº 59 190	08/09/66		25%		09/09/66
Ministerial Act CNP nº 94	01/07/76	Pernambuco	10% < > 11%		
Ministerial Act CNP nº 96	02/07/76	São Paulo	11% < > 12%		
Ministerial Act CNP nº 163	04/10/76	Pernambuco/ Alagoas	11% < > 15%		
Ministerial Act CNP nº 5	07/01/77	Paraná	10% < > 15%		
Ministerial Act CNP nº 88	19/05/77	São Paulo	11% < > 13%		
		São Paulo (metropolitan region)	18% < > 20%		
Ministerial Act CNP nº 104	06/06/77	Rio de Janeiro	10% < > 12%		
Ministerial Act CNP nº 130	21/07/77	Paraná			
Ministerial Act CNP nº 142	03/08/77	Ceará			
Ministerial Act CNP nº 174	21/09/77	Various Northeast States	18% < > 20%		
Ministerial Act CNP nº 198	20/10/77	São Paulo (North), Minas Gerais (South)			
Ministerial Act CNP nº 234	20/12/77	São Paulo			
Ministerial Act CNP nº 39	03/02/78	Northeast	20% < > 23%		
Ministerial Act CNP nº 94	25/04/78	Ceará/ Rio Grande do Norte/ Paraíba/ Pernambuco/ Alagoas	23% < > 25%		
Ministerial Act CNP 213	26/07/78	Center-South	20%		
Ministerial Act CNP nº 325	05/09/78	Northeast			
Ministerial Act CNP nº 157	22/04/81	Northeast	12%		
Ministerial Act CNP nº 245	30/06/81	Center-South			
CNE	28/09/81	Nationwide			
Ministerial Act CNP nº 443	17/12/81		15%		
Ministerial Act CNE nº 12	05/01/82		20%		
Ministerial Act CNP nº 191	18/05/82	Center-South	20%		
Minister decision - Ministry of Mines and Energy		Nationwide	20%		
Telex CNE nº 3.292/1983					
Ministerial Act CNP nº 190	15/06/83				
Ministerial Act CNP nº 144	20/06/84		22%		
Ministerial Act CNP nº 19	13/03/89		18%		
Ministerial Act CNP nº 98	07/08/89	São Paulo (metropolitan region)	22%		
Ministerial Act MIC/MME nº 417	31/08/89	Reducing the level of anhydrous ethanol in gasoline "			
Ministerial Act CNP nº 111	04/09/89	BRAZIL (except São Paulo - metropolitan region)	13%		
		São Paulo (metropolitan region)	22%		
Ministerial Act CNP nº 143	16/11/89	BRAZE	13%		
Telex DNC nº 265	12/06/90	São Paulo	22%		
Telex DNC nº 510	03/07/90	Area supplied by "Manguinhos" refinery			
Ministerial Act DNC nº 23	23/09/92	Nationwide			
Law nº 8.723 - Art. 9º	28/10/93				29/10/93
Medida Provisória nº 1.662	28/05/98		22% < > 24%		28/05/98
Decree 2.607	28/05/98		24%		15/06/98
Medida Provisória nº 2.053-29	04/08/00		20% < > 24%		07/08/00
Decree nº 3.552	04/08/00		20%		20/08/00
Decree nº 3.824	29/05/01		22%		31/05/01
Decree nº 3.966	10/10/01		Responsability of Brazilian Minister of Agriculture, Livestock and Supply regarding the establishment of ethanol gasoline mixture		
Ministerial Act MAPA nº 589	10/12/01		24%		10/01/02
Law nº 10.464 - Art. 16	24/05/02		20% < > 25%		27/05/02
Ministerial Act MAPA nº 266	21/06/02		25%		01/07/02
Ministerial Act MAPA nº 17	22/01/03		20%		01/02/03
Ministerial Act MAPA nº 554	27/05/03		25%		01/06/03
Ministerial Act MAPA nº 429	13/10/05	Area supplied from Manaus (Amazonas)	20%		14/10/05
Ministerial Act MAPA n 51	22/02/06	Nationwide	20%		01/03/06
Ministerial Act MAPA n 278	10/11/06	Nationwide	23%		20/11/06
Ministerial Act MAPA n 143	27/06/07	Nationwide	25%		01/07/07

<u>Source</u>: Brazilian Ministry of Agriculture.

EXHIBIT C

Harvest update

Bi-weekly bulletin

Position until 03/16/2013

Table 1. 2012/2013 harvest season: from April 1, 2012 to March 16, 2013.

Products		South-Central region			São Paulo			Others states		
		Final Number 2011/2012[4]	2012/2013	Var. (%)	Final Number 2011/2012[4]	2012/2013	Var. (%)	Final Number 2011/2012[4]	2012/2013	Var. (%)
Sugarcane [1]		493,159	532,607	↑ 8.00%	304,230	329,831	↑ 8.42%	188,929	202,777	↑ 7.33%
Sugar [1]		31,304	34,094	↑ 8.91%	21,068	23,286	↑ 10.53%	10,236	10,808	↑ 5.58%
Anhydrous ethanol [2]		7,466	8,775	↑ 17.53%	4,755	5,618	↑ 18.16%	2,711	3,156	↑ 16.42%
Hydrous ethanol [2]		13,076	12,591	↓ -3.71%	6,786	6,204	↓ -8.57%	6,290	6,387	↑ 1.53%
Total ethanol [2]		20,542	21,365	↑ 4.01%	11,541	11,822	↑ 2.44%	9,001	9,543	↑ 6.01%
ATR [1]		67,830	72,233	↑ 6.49%	41,802	44,665	↑ 6.85%	26,028	27,568	↑ 5.92%
ATR/ ton of sugarcane [3]		137.54	135.62	↓ -1.40%	137.40	135.42	↓ -1.44%	137.77	135.95	↓ -1.32%
Share(%)	sugar	48.44%	49.54%	↑	52.89%	54.72%	↑	41.27%	41.14%	↓
	ethanol	51.56%	50.46%	↓	47.11%	45.28%	↓	58.73%	58.86%	↑
Liters of ethanol / ton of sugar		41.65	40.11	↓ -3.70%	37.93	35.84	↓ -5.51%	47.64	47.06	↓ -1.22%
Kilograms of sugar / ton of sugar		63.48	64.01	↑ 0.84%	69.25	70.60	↑ 1.95%	54.18	53.30	↓ -1.63%

Source: UNICA. Note: [1] - thousand tons; [2] - million liters; [3] - kg of ATR/ ton of sugarcane; data subject to minor adjustments; "ATR" is the amount of product obtained per ton of crushed sugarcane; [4] - Final figures of 2011/2012 harvest season on South-Central region.

Table 2. Sugarcane harvest per State of South-Central region - 2012/2013 harvest season: from April 1, 2012 to March 16, 2013.

STATE	Sugarcane¹		Sugar¹		Total ethanol²		Anhydrous ethanol ²		Hydrous ethanol ²	
	2011/2012[3]	2012/2013	2011/2012[3]	2012/2013	2011/2012[3]	2012/2013	2011/2012[3]	2012/2013	2011/2012[3]	2012/2013
ES	4,180,168	3,519,207	122,235	98,762	224,106	177,623	143,095	109,002	81,011	68,621
GO	45,220,066	52,726,898	1,752,299	1,875,260	2,677,000	3,129,641	668,057	816,803	2,008,943	2,312,838
MT	13,153,709	16,318,765	398,192	491,919	843,942	974,373	320,807	457,623	523,135	516,750
MS	33,859,650	37,291,146	1,587,746	1,741,908	1,631,250	1,915,793	430,842	470,367	1,200,408	1,445,426
MG	49,741,239	51,759,457	3,238,089	3,418,321	2,083,987	2,002,430	780,523	873,152	1,303,464	1,129,278
PR	40,505,746	39,706,301	3,007,991	3,086,138	1,402,054	1,298,335	367,689	429,320	1,034,365	869,015
RJ	2,173,750	1,421,948	129,666	95,342	75,758	37,469	0	0	75,758	37,469
RS	95,054	32,852	0	0	6,570	1,665	0	0	6,570	1,665
SP	304,229,861	329,830,906	21,067,954	23,286,169	11,597,637	11,827,880	4,742,656	5,623,918	6,854,981	6,203,962
TOTAL	**493,159,243**	**532,607,480**	**31,304,172**	**34,093,819**	**20,542,304**	**21,365,209**	**7,453,669**	**8,780,185**	**13,088,635**	**12,585,024**

STATE	Kg TRS/ton of sugarcane		Kg of sugar/ton of sugarcane		Liters of ethanol/ ton of sugar		Sugar mix (%)		Ethanol mix (%)	
	2011/2012[3]	2012/2013	2011/2012[3]	2012/2013	2011/2012[3]	2012/2013	2011/2012[3]	2012/2013	2011/2012[3]	2012/2013
ES	123.05	116.31	29.24	28.06	53.61	50.47	24.94%	25.32%	75.06%	74.68%
GO	140.97	137.94	38.75	35.57	59.20	59.36	28.85%	27.06%	71.15%	72.94%
MT	141.09	133.76	30.27	30.14	64.16	59.71	22.52%	23.65%	77.48%	76.35%
MS	130.89	136.05	46.89	46.71	48.18	51.37	37.60%	36.03%	62.40%	63.97%
MG	139.69	135.39	65.10	66.04	41.90	38.69	48.91%	51.19%	51.09%	48.81%
PR	136.62	137.17	74.26	77.72	34.61	32.70	57.05%	59.47%	42.95%	40.53%
RJ	121.02	114.54	59.65	67.05	34.85	26.35	51.73%	61.44%	48.27%	38.56%
RS	115.85	84.95	0.00	0.00	69.12	50.68	0.00%	0.00%	0.00%	0.00%
SP	137.71	135.45	69.25	70.60	38.12	35.86	52.78%	54.70%	47.22%	45.30%
TOTAL	**137.54**	**135.62**	**63.48**	**64.01**	**41.65**	**40.11**	**48.44%**	**49.54%**	**51.56%**	**50.46%**

Source: UNICA. Note: ¹ - tons; ² - m³; [3] - Final figures of 2011/2012 harvest season on South-Central region.

Table 3. Sugarcane harvest by autonomous distilleries and mixed production mills in South-Central region - 2012/2013 harvest season: from April 1, 2012 to March 16, 2013.

Mills	2011/2012[3]	2012/2013
Mixed production mills		
Sugarcane[1]	423,093,409	456,681,015
Sugar[1]	31,304,172	34,093,819
Anhydrous ethanol[2]	6,101,897	7,543,173
Hydrous ethanol[2]	8,628,159	8,802,023
Total ethanol[2]	14,730,056	16,345,196
Distilleries		
Sugarcane[1]	70,065,834	75,926,465
Sugar[1]	0	0
Anhydrous ethanol[2]	1,351,772	1,237,012
Hydrous ethanol[2]	4,460,476	3,783,001
Total ethanol[2]	5,812,248	5,020,013

Source: UNICA. Note: [1] - tons; [2] - m^3; [3] - Final figures of 2011/2012 harvest season on South-Central region; autonomous distilleries are plants dedicated exclusively to ethanol production; mixed production mills are dedicated to producing both ethanol and sugar.

Table 4. Bi-weekly sugarcane crushing, ACCUMULATED - results for the South-Central region

Bi-weekly period	SUGARCANE (tons)								
	São Paulo			South-Central region			Others states		
	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)
16/04	3,429,398	2,130,641	-38%	6,989,642	4,736,769	-32%	3,560,244	2,606,128	-27%
01/05	14,172,087	6,753,397	-52%	24,003,829	14,133,076	-41%	9,831,742	7,379,679	-25%
16/05	35,843,615	18,078,715	-50%	57,216,373	35,014,193	-39%	21,372,758	16,935,478	-21%
01/06	63,615,028	40,950,372	-36%	100,451,296	70,798,058	-30%	36,836,268	29,847,686	-19%
16/06	85,486,055	55,094,486	-36%	135,444,365	96,674,881	-29%	49,958,310	41,580,395	-17%
01/07	112,189,980	73,838,517	-34%	177,695,752	128,377,825	-28%	65,505,772	54,539,308	-17%
16/07	138,324,825	100,037,254	-28%	218,279,009	170,572,914	-22%	79,954,184	70,535,660	-12%
01/08	165,525,368	128,355,725	-22%	260,045,132	216,850,039	-17%	94,519,764	88,494,314	-6%
16/08	189,559,044	155,949,298	-18%	298,789,785	261,096,423	-13%	109,230,741	105,147,125	-4%
01/09	214,665,309	185,033,425	-14%	339,505,503	307,615,408	-9%	124,840,194	122,581,983	-2%
16/09	237,903,355	211,142,346	-11%	376,713,354	349,583,250	-7%	138,809,999	138,440,904	0%
01/10	260,911,204	229,995,069	-12%	413,586,476	381,351,364	-8%	152,675,272	151,356,295	-1%
16/10	274,880,543	254,509,209	-7%	437,024,431	419,347,426	-4%	162,143,888	164,838,217	2%
01/11	288,665,706	277,010,496	-4%	460,154,964	455,494,097	-1%	171,489,258	178,483,601	4%
16/11	299,227,781	294,955,779	-1%	478,748,045	481,986,144	1%	179,520,264	187,030,365	4%
01/12	303,480,093	314,572,839	4%	487,972,714	510,593,620	5%	184,492,621	196,020,781	6%
16/12	304,141,517	327,137,555	8%	490,712,566	528,155,576	8%	186,571,049	201,018,021	8%
01/01	304,182,530	329,070,599	8%	491,632,455	531,311,133	8%	187,449,925	202,240,534	8%
16/01	304,182,530	329,432,882	8%	492,093,742	531,853,466	8%	187,911,212	202,420,584	8%
01/02	304,182,530	329,652,510	8%	492,570,379	532,260,252	8%	188,387,849	202,607,742	8%
16/02	304,190,975	329,674,913	8%	492,819,542	532,415,545	8%	188,628,567	202,740,632	7%
01/03	304,206,473	329,775,007	8%	493,021,705	532,551,581	8%	188,815,232	202,776,574	7%
16/03	304,212,220	329,830,906	8%	493,111,109	532,607,480	8%	188,898,889	202,776,574	7%
01/04									

Source: UNICA.

Table 5. Bi-weekly sugar production, ACCUMULATED - results for the South-Central region

Bi-weekly period	SUGAR (tons)								
	São Paulo			South-Central region			Others states		
	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)
16/04	95,775	71,742	-25%	214,065	152,083	-29%	118,290	80,341	-32%
01/05	490,217	290,985	-41%	817,574	545,249	-33%	327,357	254,264	-22%
16/05	1,564,223	874,723	-44%	2,373,839	1,569,285	-34%	809,616	694,562	-14%
01/06	3,225,032	2,243,638	-30%	4,784,139	3,528,807	-26%	1,559,107	1,285,169	-18%
16/06	4,608,640	3,086,027	-33%	6,804,384	4,895,032	-28%	2,195,744	1,809,005	-18%
01/07	6,386,132	4,261,147	-33%	9,402,197	6,690,215	-29%	3,016,065	2,429,068	-19%
16/07	8,219,976	6,064,817	-26%	11,987,619	9,324,855	-22%	3,767,643	3,260,038	-13%
01/08	10,239,469	8,061,881	-21%	14,813,562	12,296,199	-17%	4,574,093	4,234,318	-7%
16/08	12,065,742	10,145,553	-16%	17,472,916	15,324,290	-12%	5,407,174	5,178,737	-4%
01/09	14,080,467	12,439,142	-12%	20,442,724	18,662,605	-9%	6,362,257	6,223,463	-2%
16/09	15,957,303	14,581,925	-9%	23,205,661	21,798,577	-6%	7,248,358	7,216,652	0%
01/10	17,882,100	16,023,279	-10%	26,050,546	24,005,312	-8%	8,168,446	7,982,033	-2%
16/10	19,062,762	17,976,137	-6%	27,831,794	26,795,758	-4%	8,769,032	8,819,621	1%
01/11	20,000,161	19,704,966	-1%	29,308,163	29,337,152	0%	9,308,002	9,632,186	3%
16/11	20,777,690	20,988,789	1%	30,580,283	31,079,495	2%	9,802,593	10,090,706	3%
01/12	21,024,117	22,352,327	6%	31,084,301	32,913,596	6%	10,060,184	10,561,269	5%
16/12	21,063,425	23,174,472	10%	31,227,609	33,957,976	9%	10,164,184	10,783,504	6%
01/01	21,067,954	23,263,073	10%	31,262,876	34,067,927	9%	10,194,922	10,804,854	6%
16/01	21,067,954	23,274,206	10%	31,275,120	34,081,825	9%	10,207,166	10,807,619	6%
01/02	21,067,954	23,274,809	10%	31,291,402	34,082,459	9%	10,223,448	10,807,650	6%
16/02	21,067,954	23,274,809	10%	31,297,834	34,082,459	9%	10,229,880	10,807,650	6%
01/03	21,067,954	23,281,165	11%	31,301,840	34,088,815	9%	10,233,886	10,807,650	6%
16/03	21,067,954	23,286,169	11%	31,304,172	34,093,819	9%	10,236,218	10,807,650	6%
01/04									

Source: UNICA.

Table 6. Bi-weekly ethanol production, ACCUMULATED - results for the South-Central region

Bi-weekly period	TOTAL ETHANOL (m³)								
	São Paulo			South-Central region			Others states		
	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)
16/04	123,189	69,127	-44%	256,493	177,878	-31%	133,304	108,751	-18%
01/05	507,988	244,100	-52%	905,735	546,704	-40%	397,747	302,604	-24%
16/05	1,288,632	617,662	-52%	2,172,978	1,319,501	-39%	884,346	701,839	-21%
01/06	2,319,531	1,374,393	-41%	3,910,089	2,613,382	-33%	1,590,558	1,238,989	-22%
16/06	3,144,923	1,850,872	-41%	5,360,948	3,611,668	-33%	2,216,025	1,760,796	-21%
01/07	4,132,242	2,478,146	-40%	7,077,891	4,818,154	-32%	2,945,649	2,340,008	-21%
16/07	5,086,608	3,364,188	-34%	8,724,164	6,422,623	-26%	3,637,556	3,058,435	-16%
01/08	6,083,669	4,322,296	-29%	10,455,657	8,205,479	-22%	4,371,988	3,883,183	-11%
16/08	6,985,509	5,283,336	-24%	12,078,967	9,956,904	-18%	5,093,458	4,673,568	-8%
01/09	7,956,774	6,345,827	-20%	13,823,044	11,881,670	-14%	5,866,270	5,535,843	-6%
16/09	8,870,944	7,341,978	-17%	15,436,669	13,691,191	-11%	6,565,725	6,349,213	-3%
01/10	9,802,418	8,099,445	-17%	17,062,784	15,127,475	-11%	7,260,366	7,028,030	-3%
16/10	10,417,849	9,037,861	-13%	18,166,789	16,743,224	-8%	7,748,940	7,705,363	-1%
01/11	10,962,684	9,865,915	-10%	19,134,304	18,226,909	-5%	8,171,620	8,360,994	2%
16/11	11,371,174	10,516,346	-8%	19,883,276	19,287,285	-3%	8,512,102	8,770,939	3%
01/12	11,551,124	11,211,829	-3%	20,271,082	20,390,794	1%	8,719,958	9,178,965	5%
16/12	11,583,512	11,700,014	1%	20,404,943	21,133,586	4%	8,821,431	9,433,572	7%
01/01	11,587,142	11,790,483	2%	20,454,986	21,294,959	4%	8,867,844	9,504,476	7%
16/01	11,588,150	11,806,701	2%	20,479,651	21,319,190	4%	8,891,501	9,512,489	7%
01/02	11,590,426	11,825,582	2%	20,503,672	21,351,590	4%	8,913,246	9,526,008	7%
16/02	11,591,897	11,825,077	2%	20,516,987	21,359,349	4%	8,925,090	9,534,272	7%
01/03	11,593,399	11,825,778	2%	20,528,816	21,362,362	4%	8,935,417	9,536,584	7%
16/03	11,595,528	11,827,880	2%	20,536,728	21,365,209	4%	8,941,200	9,537,329	7%
01/04									

Source: UNICA.

Table 7. Bi-weekly ethanol production, ACCUMULATED - results for the South-Central region

Bi-weekly period	ANHYDROUS ETHANOL (m³)								
	São Paulo			South-Central region			Others states		
	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)
16/04	33,627	-38,523	-215%	60,139	-42,738	-171%	26,512	-4,215	-116%
01/05	211,120	-56,891	-127%	336,107	-48,318	-114%	124,987	8,573	-93%
16/05	547,545	37,727	-93%	843,136	124,602	-85%	295,591	86,875	-71%
01/06	973,237	336,240	-65%	1,472,779	560,371	-62%	499,542	224,131	-55%
16/06	1,285,114	553,432	-57%	1,945,225	965,520	-50%	660,111	412,088	-38%
01/07	1,692,642	828,077	-51%	2,548,672	1,456,072	-43%	856,030	627,995	-27%
16/07	2,104,663	1,253,822	-40%	3,163,990	2,131,274	-33%	1,059,327	877,452	-17%
01/08	2,558,415	1,737,433	-32%	3,849,025	2,908,935	-24%	1,290,610	1,171,502	-9%
16/08	2,961,059	2,228,263	-25%	4,497,189	3,687,942	-18%	1,536,130	1,459,679	-5%
01/09	3,423,351	2,775,266	-19%	5,233,357	4,546,325	-13%	1,810,006	1,771,059	-2%
16/09	3,861,669	3,295,324	-15%	5,899,236	5,357,256	-9%	2,037,567	2,061,932	1%
01/10	4,283,534	3,701,928	-14%	6,562,953	5,991,157	-9%	2,279,419	2,289,229	0%
16/10	4,570,585	4,207,235	-8%	7,024,963	6,744,304	-4%	2,454,378	2,537,069	3%
01/11	4,809,441	4,662,373	-3%	7,417,651	7,429,091	0%	2,608,210	2,766,718	6%
16/11	4,956,446	5,017,516	1%	7,704,910	7,948,063	3%	2,748,464	2,930,547	7%
01/12	4,998,009	5,366,915	7%	7,801,802	8,438,034	8%	2,803,793	3,071,119	10%
16/12	4,996,369	5,616,428	12%	7,819,640	8,788,334	12%	2,823,271	3,171,906	12%
01/01	4,985,960	5,653,326	13%	7,818,793	8,846,641	13%	2,832,833	3,193,315	13%
16/01	4,963,789	5,660,147	14%	7,795,769	8,852,946	14%	2,831,980	3,192,799	13%
01/02	4,902,265	5,665,363	16%	7,728,543	8,857,682	15%	2,826,278	3,192,319	13%
16/02	4,870,311	5,648,590	16%	7,683,738	8,839,742	15%	2,813,427	3,191,152	13%
01/03	4,856,638	5,633,423	16%	7,637,904	8,812,835	15%	2,781,266	3,179,412	14%
16/03	4,817,814	5,623,918	17%	7,560,423	8,780,185	16%	2,742,609	3,156,267	15%
01/04									

Source: UNICA. Note: The production considered the conversion of anhydrous ethanol into hydrous ethanol in South-Central region of Brazil (m³).

Table 8. Bi-weekly hydrous ethanol production, ACCUMULATED - results for the South-Central region

Bi-weekly period	HYDROUS ETHANOL (m³)								
	São Paulo			South-Central region			Others states		
	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)	2011/12	2012/13	Var. (%)
16/04	89,562	107,650	20%	196,354	220,616	12%	106,792	112,966	6%
01/05	296,868	300,991	1%	569,628	595,022	4%	272,760	294,031	8%
16/05	741,087	579,935	-22%	1,329,842	1,194,899	-10%	588,755	614,964	4%
01/06	1,346,294	1,038,153	-23%	2,437,310	2,053,011	-16%	1,091,016	1,014,858	-7%
16/06	1,859,809	1,297,440	-30%	3,415,723	2,646,148	-23%	1,555,914	1,348,708	-13%
01/07	2,439,600	1,650,069	-32%	4,529,219	3,362,082	-26%	2,089,619	1,712,013	-18%
16/07	2,981,945	2,110,366	-29%	5,560,174	4,291,349	-23%	2,578,229	2,180,983	-15%
01/08	3,525,254	2,584,863	-27%	6,606,632	5,296,544	-20%	3,081,378	2,711,681	-12%
16/08	4,024,450	3,055,073	-24%	7,581,778	6,268,962	-17%	3,557,328	3,213,889	-10%
01/09	4,533,423	3,570,561	-21%	8,589,687	7,335,345	-15%	4,056,264	3,764,784	-7%
16/09	5,009,275	4,046,654	-19%	9,537,433	8,333,935	-13%	4,528,158	4,287,281	-5%
01/10	5,518,884	4,397,517	-20%	10,499,831	9,136,318	-13%	4,980,947	4,738,801	-5%
16/10	5,847,264	4,830,626	-17%	11,141,826	9,998,920	-10%	5,294,562	5,168,294	-2%
01/11	6,153,243	5,203,542	-15%	11,716,653	10,797,818	-8%	5,563,410	5,594,276	1%
16/11	6,414,728	5,498,830	-14%	12,178,366	11,339,222	-7%	5,763,638	5,840,392	1%
01/12	6,553,115	5,844,914	-11%	12,469,280	11,952,760	-4%	5,916,165	6,107,846	3%
16/12	6,587,143	6,083,586	-8%	12,585,303	12,345,252	-2%	5,998,160	6,261,666	4%
01/01	6,601,182	6,137,157	-7%	12,636,193	12,448,318	-1%	6,035,011	6,311,161	5%
16/01	6,624,361	6,146,554	-7%	12,683,882	12,466,244	-2%	6,059,521	6,319,690	4%
01/02	6,688,161	6,160,219	-8%	12,775,129	12,493,908	-2%	6,086,968	6,333,689	4%
16/02	6,721,586	6,176,487	-8%	12,833,249	12,519,607	-2%	6,111,663	6,343,120	4%
01/03	6,736,761	6,192,355	-8%	12,890,912	12,549,527	-3%	6,154,151	6,357,172	3%
16/03	6,777,714	6,203,962	-8%	12,976,305	12,585,024	-3%	6,198,591	6,381,062	3%
01/04									

Source: UNICA.

Table 9. Ethanol sales by mills in South-Central region, per ethanol type and destination (m³).

Product	Month	Total		External market		Domestic market	
		2011/12	2012/13	2011/12	2012/13	2011/12	2012/13
Total ethanol	Apr	1,126,450	1,395,327	16,499	73,115	1,109,951	1,322,212
	May	1,830,070	1,642,224	108,214	151,794	1,721,856	1,490,430
	Jun	2,172,395	1,661,781	228,404	233,801	1,943,991	1,427,980
	Jul	2,082,153	1,921,828	299,610	425,803	1,782,543	1,496,025
	Aug	2,047,911	2,078,714	207,357	480,847	1,840,554	1,597,867
	Sep	1,857,473	1,955,985	190,879	478,484	1,666,594	1,477,501
	Oct	1,785,258	2,143,485	240,870	426,734	1,544,388	1,716,751
	Nov	1,755,822	2,116,872	238,180	439,244	1,517,642	1,677,628
	Dec	1,522,438	1,919,814	111,384	291,012	1,411,054	1,628,802
	Jan	1,283,428	2,062,619	42,445	229,549	1,240,983	1,833,070
	Feb	1,329,619	1,632,073	52,172	115,358	1,277,447	1,516,715
	Mar*	820,124	794,490	38,096	13,211	782,028	781,279
	Total	**19,613,141**	**21,325,212**	**1,774,110**	**3,358,952**	**17,839,031**	**17,966,260**
Anhydrous ethanol	Apr	600,360	528,692	793	54,601	599,567	474,091
	May	689,833	645,743	37,655	119,235	652,178	526,508
	Jun	675,265	753,708	39,000	190,586	636,265	563,122
	Jul	722,977	868,957	82,638	285,213	640,339	583,744
	Aug	708,027	896,575	55,814	318,270	652,213	578,305
	Sep	716,532	861,088	70,438	330,093	646,094	530,995
	Oct	642,564	869,128	85,318	248,928	557,246	620,200
	Nov	733,358	858,597	159,896	257,413	573,462	601,184
	Dec	658,122	775,491	86,870	171,765	571,252	603,726
	Jan	509,421	767,875	28,766	94,052	480,655	673,823
	Feb	511,266	649,526	51,952	102,222	459,314	547,304
	Mar*	333,301	310,546	33,818	12,805	299,483	297,741
	Total	**7,501,026**	**8,785,926**	**732,958**	**2,185,183**	**6,768,068**	**6,600,743**
Hydrous ethanol	Apr	526,090	866,635	15,706	18,514	510,384	848,121
	May	1,140,237	996,481	70,559	32,559	1,069,678	963,922
	Jun	1,497,130	908,073	189,404	43,215	1,307,726	864,858
	Jul	1,359,176	1,052,871	216,972	140,590	1,142,204	912,281
	Aug	1,339,884	1,182,139	151,543	162,577	1,188,341	1,019,562
	Sep	1,140,941	1,094,897	120,441	148,391	1,020,500	946,506
	Oct	1,142,694	1,274,357	155,552	177,806	987,142	1,096,551
	Nov	1,022,464	1,258,275	78,284	181,831	944,180	1,076,444
	Dec	864,316	1,144,323	24,514	119,247	839,802	1,025,076
	Jan	774,007	1,294,744	13,679	135,497	760,328	1,159,247
	Feb	818,353	982,547	220	13,136	818,133	969,411
	Mar*	486,823	483,944	4,278	406	482,545	483,538
	Total	**12,112,115**	**12,539,286**	**1,041,152**	**1,173,769**	**11,070,963**	**11,365,517**

Source: UNICA. Note: Anhydrous ethanol sales to domestic market include the volumes imported by producers and non producers. Mar* data refers to the 1st two-week period of March.

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Data released in this report has been compiled and analyzed by UNICA, with figures provided by mills and by the following associations of producers from South-Central states:

- *Ethanol and sugar producers association in the state of Paraná (Alcopar);*
- *Bioenergy producers association of Mato Grosso do Sul (Biosul);*
- *Sugar and ethanol industries association in the state of Minas Gerais (SIAMIG);*
- *Association of ethanol industry of Goiás state (SIFAEG);*
- *Sugar and ethanol industry association of Mato Grosso (SINDALCOOL);*
- *Plants and distilleries society of Espírito Santo state (SUDES);*
- *"Fluminense" association of sugar and ethanol producers (SINDAAF).*

Data regarding weather and agricultural conditions has been provided by the Center for Sugarcane Technology (CTC).

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