ABBI
Associação Brasileira de Biotecnologia Industrial

February 17, 2015

To
ARB's Public Information Office
Air Resources Board
1001 I Street
Visitors and Environmental Services Center – First Floor
Sacramento, CA 95814

Re. ABBI's comments on the Proposed Re-Adoption of the Low Carbon Fuel Standard

Dear Sirs,

The Brazilian Industrial Biotechnology Association (*Associação Brasileira de Biotecnologia Industrial* – "ABBI") welcomes this opportunity to provide comments on the Proposed Re-Adoption of the Low Carbon Fuel Standard – LCFS (the "Proposed Re-Adoption"), published on December 30, 2014 by the Air Resources Board – ARB, a body within the California Environmental Protection Agency.

ABBI is a non-profit organization based in São Paulo, Brazil, established with the purpose of acting in a global level to promote the country's biochemical and biofuels industry. The Association is composed of leading global and local industrial biotechnology companies, acting together towards the biotechnology-based industry's sustainable development.

As further detailed below, the adoption of the Brazilian average electricity mix, based on outdated and inaccurate electricity generation data, as established in Table 9 of the CA-GREET 2.0 Supplemental Document and Tables of Changes (page C-22) for the calculation of Carbon Intensity (CI) credits derived from the export of electricity to the grid, if approved as proposed, shall adversely affect Brazilian ethanol producers which already – or plan to – export ethanol to potential off-takers in the State of California.

1. Introduction:

The proposed CA-GREET 2.0 adopts the electricity mixes associated with the 26 eGRID subregions, based on the US EPA's Emissions & Generation Resource Integrated Database (eGRID), instead of the 2010 10-region North American Electric Reliability Corporation (NERC) regions, which was used in the replaced GREET1 2013. In addition, the ARB is proposing to create a Brazilian average electricity mix, based on EIA's Country Analysis Brief website report for Brazil, as provided in Table 9 – 2010 Brazil Electricity Resource Mix (page C-22 of the of the CA-GREET 2.0 Supplemental Document and Tables of Changes):

CA-GREET 2.0 Proposed Brazil Electricity Resource Mix, 2010[1]

Brazil Electricity Generation Resource Mix (GREET 2013 category)	EIA Brazil (10^9kWh)	Modified Brazil CA-GREET 2.0 (%)
Fossil (Natural gas)	55	11%
Other renewables (Biomass)	35	7%
Nuclear (Nuclear)	10	2%
Hydro (Hydro)	400	80%
Total	500	100%

Source: California Air Resources Board

2. *Electricity Generation in Brazil:*

According to the Brazilian Energy Research Company (*Empresa de Pesquisa Energética – EPE*), a government agency within the Ministry of Mines and Energy, the Brazilian electricity mix is as follows:

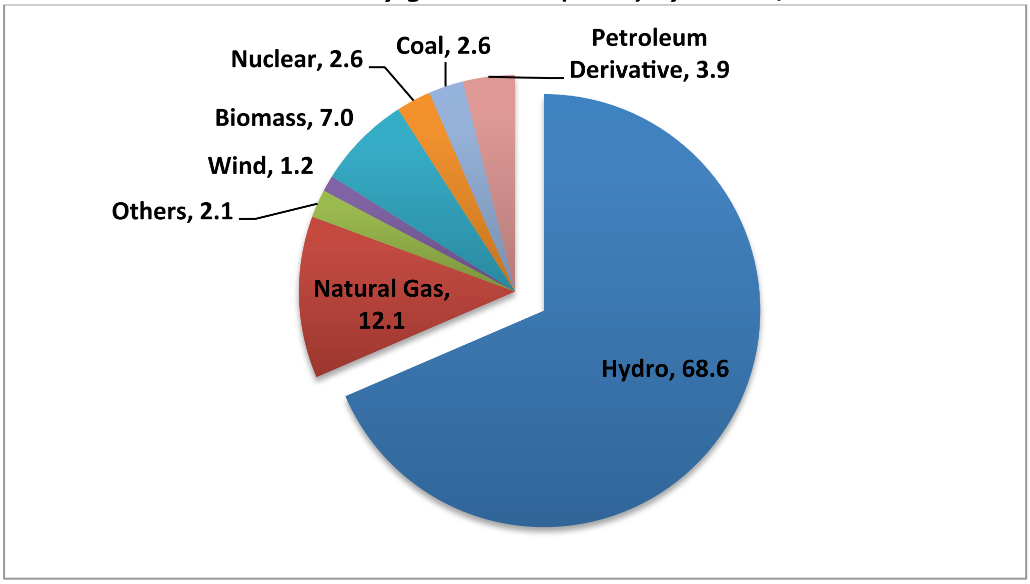
Chart 1: Brazil electricity generation by source (GWh)[2]

Type	Source	2009	2010	2011	2012	2013	2013 part. % (per source)	2013 part. % (per type)
Hydro	Hydro	390.988	403.290	428.333	415.342	390.992	68,6	68,6
Fossil	Natural gas	13.332	36.476	25.095	46.760	69.003	12,1	18,6
	Petroleum	12.724	14.216	12.239	16.214	22.090	3,9	
	Coal	5.429	6.992	6.485	8.422	14.801	2,6	
Biomass	Bagasse, wood and others	21.851	31.209	31.633	34.662	39.679	7,0	7,0
Nuclear	Uranium	12.957	14.523	15.659	16.038	14.640	2,6	2,6
Wind	Wind	1.238	2.177	2.705	5.050	6.576	1,2	1,2
Others	Recoveries, secondary gases	7.640	6.916	9.609	10.010	12.244	2,1	2,1
Total		466.158	515.799	531.758	552.498	570.025	100,0	100,0

Source: Brazilian Energy Research Company (EPE), 2014 Statistical Yearbook of Electricity

[1] Table 9 of the CA-GREET 2.0 Supplemental Document and Tables of Changes (page C-22)
[2]http://www.epe.gov.br/AnuarioEstatisticodeEnergiaEletrica/Anu%C3%A1rio%20Estat%C3%ADstico%20de%20Energia%20El%C3%
[2]http://www.epe.gov.br/AnuarioEstatisticodeEnergiaEletrica/Anu%C3%A1rio%20Estat%C3%ADstico%20de%20Energia%20El%C3%A9trica%202014.pdf

Chart 2: Brazil 2013 electricity generation (GWh) by source, %



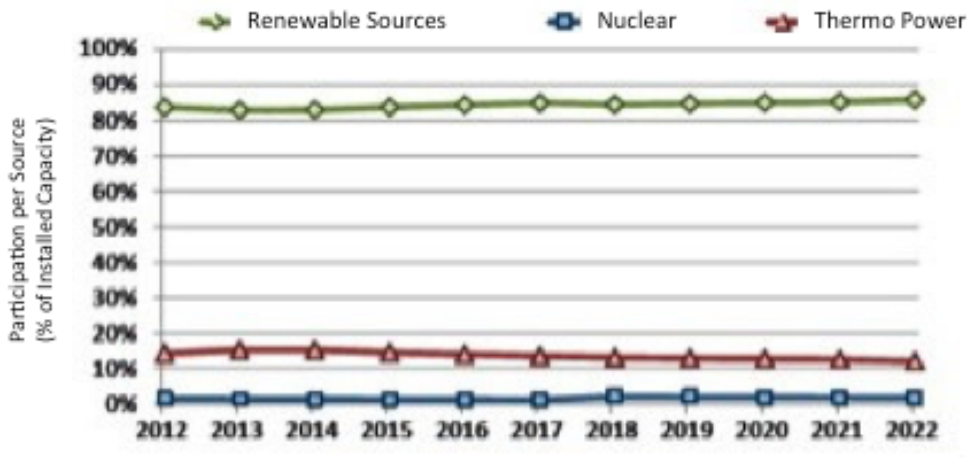
Source: Brazilian Energy Research Company (EPE), 2014 Statistical Yearbook of Electricity

As seen above (chart 2), the Brazilian electricity mix is still heavily dependent on the generation of electricity from hydro power plants, which includes large plants, such as Itaipú (with an installed capacity of 14,000 MW) and Tucuruí (with an installed capacity of 8,370 MW), as well as small hydroelectric plants (*Pequenas Centrais Hidrelétricas – PCHs*), which are limited to 30 MW capacity each. Hydro power installed capacity in Brazil is currently 89,224 MW and, if all new hydro power plants start operations according to the schedule, by 2021 and additional hydro power capacity of 21,774 MW shall be added to the national grid.

However, due to hydrological crisis which affects Brazil since 2010/2011, the capacity of the hydro power plants' reservoirs are currently below 20% (twenty percent) in the Southeast and Northeast regions[3] (which represents 69% of Brazil's total electricity consumption), meaning that the existing hydro power plants have been operating far below their installed capacity and the additional capacity to be delivered by the new hydro power plants shall not be sufficient to reduce the participation of fossil sources plants in the Brazilian electricity mix, which installed capacity shall account to 14.2% (fourteen point two percent) in 2016 and 12.3% (twelve point three percent) in 2022, according to official estimates prepared by the EPE, as shown in the charts below:

[3] Hydro power plants reservoirs status on Jan 12, 2015: Southeast and Center West regions: 19.29%; South region: 70.04%; Northeast region: 17.9% and North region: 35.06% (Source: ONS);

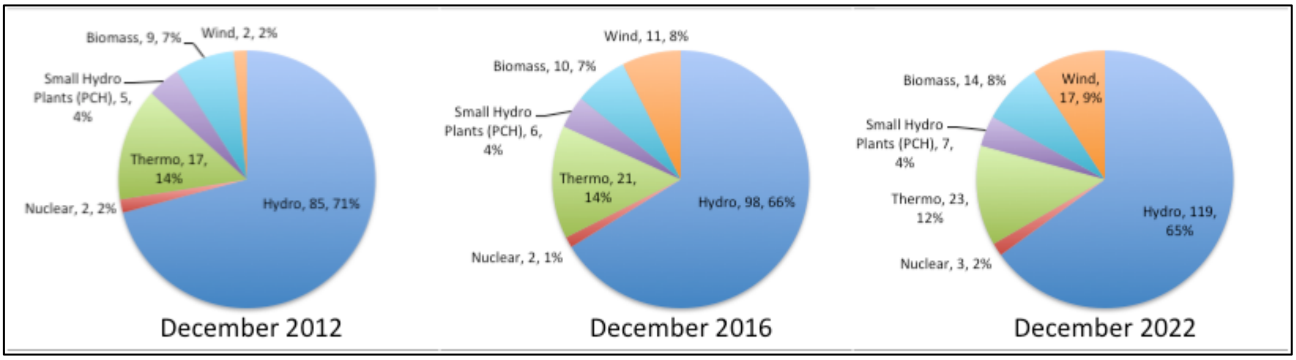
Chart 3: Development of sources participation on SIN's installed capacity



Source: Brazilian Energy Research Company (EPE)

The Brazilian electricity system is connected through the National Interconnected System (*Sistema Interligado Nacional – SIN*), which is monitored by the National Operator of the Electricity System (*Operador Nacional do Sistema Elétrico – ONS*), a non-profit organization regulated by the National Electricity Energy Agency (*Agencia Nacional de Energia Elétrica - ANEEL*). Under the SIN, the hydropower plants, which have lower operational costs as compared to the other sources, operate in full capacity, while fossil sources plants (i.e. natural gas, petroleum products and coal), which have higher operational costs, operate "on demand", by means of the so-called dispatch orders issued by the ONS, according to the system's needs.

Chart 4: Evolution of Brazil electricity generation by source (GWh)[5]



Source: Ten-Year Plan for Energy Expansion – PDE, Brazilian Energy Research Company (EPE)

Periodically, two reports are prepared by the ONS: (i) the Energy Operation Planning (*Planejamento de Operação Estratégica – POE*), with the purpose of presenting a 5-year planning for the electricity generated to and consumed from the SIN; and (ii) Annual Electricity Operation Planning (*Planejamento de Operação Elétrica Anual – POEA*), a study which offers the diagnosis of the SIN performance and provides a forecast of the generation and consumption of electricity in a 1-year

[5] http://www.epe.gov.br/pdee/forms/epeestudo.aspx

period. The POEA is the study that subsidies ANEEL's decisions to increase or reduce the electricity to be generated by the fossil sources plants within a certain period of time.

Due to (i) the increase of electricity demand over the years; (ii) the severe hydrological crisis which affects the sector since 2011 (as explained above); and (iii) the lack of sufficient investments in new projects; the fossil source plants have been registering, since 2008, the highest increases in installed capacity in Brazil (see Chart 5 below) and, since 2011, have been operating close to full capacity to meet the system's needs.

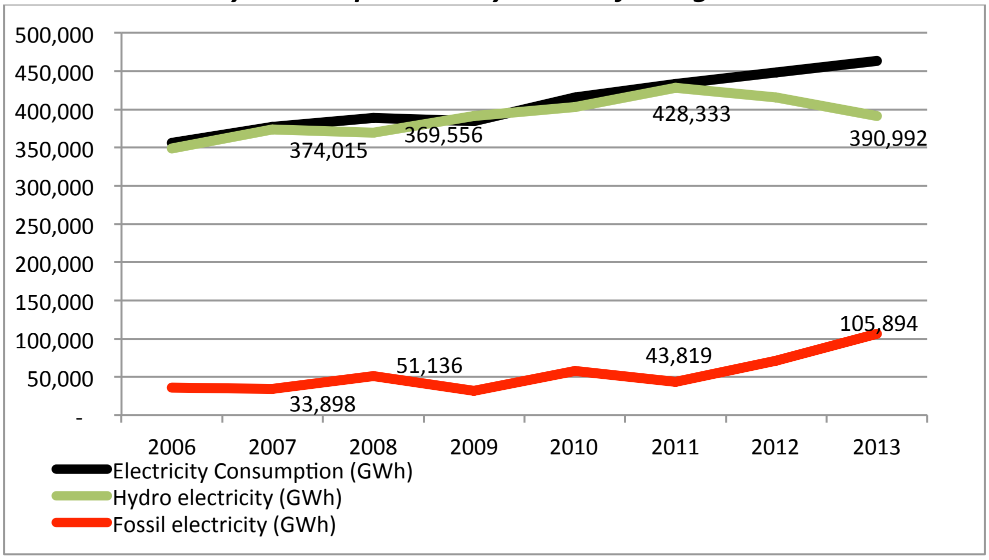
Chart 5: Start-up of new electricity plants (in MW)

	2008	2009	2010	2011	2012	2013	Total	%
Thermal (fossil + biomass)	1.243,90	2.224,00	3.762,80	2.125,54	1.670,08	3.717,35	14.743,67	57,57
Hydro	822,84	1.074,18	2.060,97	1.575,47	1.856,64	1.525,17	8.915,27	34,81
Wind	91,30	266,93	325,60	498,35	456,19	313,19	1.951,56	7,62
							25.610,50	**100**

Source: National Electricity Energy Agency - ANEEL

Until 2010/2011, the generation of hydro electricity was capable of meeting most of Brazil's electricity demand, and other sources of electricity were used only for brief periods of hydro electricity shortages imposed by water scarcity during dry seasons or consumption peaks. As from 2011, the hydro electricity became no longer capable to meet the national needs and the fossil sources' plants started playing a critical role in the Brazilian electricity sector, increasing the electricity generation from 43,819 GWh in 2011 to 105,894 GWh in 2013, as shown below:

Chart 6: Electricity consumption vs. hydro and fossil generation



Source: EPE, prepared by ABBI

The tables and charts above and Chart 7 below prove the reduction of the participation of hydropower plants and the increase of fossil sources plants in the Brazilian electricity mix, from 79.8% and 11.04%, respectively, in 2008, to 68.6% and 18.6% in 2013. They also evidence how dependent is Brazil on the electricity generated by the fossil sources plants (i.e. natural gas, petroleum and coal).

As explained by Vahl and Casarotto Filho, whose study suggests that by 2022 thermal plants shall be the main source of electricity in Brazil, surpassing the hydropower market share, ***"dispatch orders and the energy mix follow seasonal demand peaks in the Brazilian grid. In order to meet demand during peak seasons, especially in summer (from December through March), the Brazilian operator*** **[i.e. ONS]** ***has hired an increasing amount of energy from thermo power plants, which are currently the primary contingency plan for the maintenance of supply and system reliability. Such strategy increases significantly the amount of GHG emissions "***[6].

They continue saying that ***"electricity production from thermal power plants has increased 694% in the Brazilian energy mix from 2005 to 2012, a pace much higher than consumption. Also, the strategy of dispatching energy from thermal power plants only in situations of low hydro energy stored no longer applies for Brazilian scenarios, since the yearly average has also grown regardless of hydro energy stored. Such plants are indeed becoming important suppliers in order to maintain balance between electricity supply and demand***[7]. The recent exploitation of petroleum in the pre-salt area, part of them with massive quantities of natural gas, also poses as a potential factor to increase even further the electricity generation from such source.

Year over year, the hydroelectric capacity has declined while fossil fuel generation has grown. This trend clearly indicates that the marginal power generation resource is from fossil fuels. In other words, as the fossil sources plants are the only ones with capacity to increase production in Brazil, they work as a marginal resource to balance the national electricity supply and demand and should therefore be considered, for any purpose, as the only sources of electricity to compose the Brazilian marginal resource mix.

Chart 7: Electricity generation 2008 x 2013

Type	Source	2008	% (per source)	% (per type)	2013	% (per source)	% (per type)
Hydro	Hydro	369.556	79,80	79,80	390.992	68,60	68,60
Fossil	Natural gas	28.778	6,21	11,04	69.003	12,10	18,60
	Petroleum	15.628	3,37		22.090	3,90	
	Coal	6.730	1,45		14.801	2,60	
Biomass	Bagasse, wood and others	19.199	4,15	4,15	39.679	7,00	7,00
Nuclear	Uranium	13.969	3,02	3,02	14.640	2,60	2,60
Wind	Wind	1.183	0,26	0,26	6.576	1,20	1,20
Others	Recoveries, secondary gases	8.076	1,74	1,74	12.244	2,10	2,10
Total		463.120	100,00	100,00	570.025	100,00	100

Source: EPE, prepared by ABBI

[6] Vahl, FP., Casarotto Filho, N., 2015, Energy transition and path creation for natural gas in the Brazilian electricity mix, Jornal of Cleaner Production 86 (pg. 221-229);
[7] Vahl, FP., Casarotto Filho, N., 2015, Energy transition and path creation for natural gas in the Brazilian electricity mix, Jornal of Cleaner Production 86 (pg. 221-229);

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3. GREET 2.0 Electricity mix methodology: average mix vs. marginal resource mix

The ARB says in the CA-GREET 2.0 Supplemental Document and Tables of Changes (page C-2) that "*Staff has adopted the mixes associated with the 26 eGRID subregions. Average rather than marginal subregional mixed are used*" and continues saying that "*Staff selected average electricity resource mixes primarily due to the uncertainty in determining the marginal resource mix accurately for each subregion*".

ABBI appreciates the difficulties to determine which type of energy should be considered as marginal for the purposes set out in the CA-GREET 2.0 in the US, in view of the different sources of electricity suppliers with availability to increase production to attend the demand. However, that is not applicable to Brazil. As demonstrated above, the only source of electricity that has been substantially increasing in Brazil since 2008 and that has installed capacity and flexibility to increase production in the short or medium term is the fossil energy, primarily from natural gas.

Therefore, the fossil energy (i.e. generated by natural gas, petroleum products and coal) should be considered the Brazilian marginal resource mix for any purposes, including for the calculation of Carbon Intensity – CI credits derived from the export of electricity to the grid by Brazilian ethanol producers.

4. Conclusion

In view of the above, ABBI hereby urges the ARB to adopt in GREET 2.0, for the calculation of Carbon Intensity – CI credits derived from the export of electricity to the grid:

(i) The actual marginal resource mix of the region where the respective mill is located. In this case, the Brazilian marginal resource mix should be composed exclusively of natural gas, petroleum and coal power plants; or alternatively,

(ii) the natural gas based electricity mix (i.e. 2010 10-region North American Electric Reliability Corporation (NERC) regions), which was used in GREET1 2013 and previous CA_GREET models, which are the measures that most accurately reflect the savings of GHG emissions caused by the export of electricity to the grid.

ABBI would be glad to provide any further information or document as deemed necessary by the ARB and renew its assurances of full support and the most distinguished consideration for the work carried out by the ARB.

Respectfully submitted,

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Brazilian Industrial Biotechnology Association – ABBI
Bernardo Mendes de Oliveira e Silva
Executive President