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February 18, 2009

Mary D. Nichols
Chair
California Air Resources Board
Headquarters Building
1001 I Street
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Dear Chair Nichols:

I am writing to share comments members of the National Biodiesel Board (NBB) believe would enhance the second version of the California-GREET model.

I would like to begin by thanking you and the California Air Resources Board (ARB) staff for incorporating two significant amendments recommended by the NBB in previous technical comments, submitted November 11, 2008. Those recommendations – lower energy requirements for soybean crushing and allocation of fossil carbon to glycerine rather than biodiesel – reduced soy-based biodiesel's carbon intensity from 35.26 g CO2eq/MJ to 26.93 g CO2eq/MJ. We sincerely appreciate your staff's kind attention to our comments as well as their high level of accessibility and professionalism during the process.

Once again, NBB has retained Don O'Connor, creator of Natural Resources Canada's GHGenius model, to evaluate the most recent version of the California-GREET model. This analysis, which is attached, focuses on calculation of co-product credits. The November 11, 2008 comments also spoke to this issue. Those recommendations, regrettably, were not accepted. Nevertheless, we have asked Mr. O'Connor to identify and put forth additional data in the hopes that the ARB would re-consider its position on this issue. It would appear that this is an area in which the ARB is, quite literally, out of step with the rest of the world. As such, we would be grateful for additional consideration on this point.

Finally, I would briefly mention that we hope the remaining pathways and indirect land use model will be released in time to provide meaningful comment before the ARB board meeting scheduled for April 23. From our perspective, it would seem difficult to approve a low carbon fuel standard that did not include final carbon intensity values for fuel pathways necessary for policy compliance.

Thank you, in advance, for your consideration of our industry's recommendations. We continue to appreciate the excellent working relationship we enjoy with Air Resources Board staff.

Sincerely,

Shelby Neal
Director of State Governmental Affairs

COMMENTS ON VERSION 2 OF SOYBEAN BIODIESEL CALIFORNIA GREET MODEL FOR THE LOW CARBON FUEL STANDARD DEVELOPMENT

Prepared For:

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EXECUTIVE SUMMARY

California has taken a lead in North America of promoting, developing, and implementing a Low Carbon Fuel Standard (LCFS) for transportation fuels. The concept is that the effective carbon content of transportation fuels will be reduced by 10% by the year 2020. The means of achieving this reduction will be left to the marketplace but the benefits of all of the fuel options will be determined through a lifecycle assessment of each fuel. Other states and some Canadian provinces have announced plans to follow California's lead or are considering doing so.

The California Air Resources Board (CARB) has begun to release a series of papers, each one covering a fuel production pathway, and inviting comments on the results and findings of the California GREET model. A report covering the soybean biodiesel (esterified soyoil) was released on October 3, 2008. The National Biodiesel Board submitted a number of comments on the initial version of the soybean biodiesel pathway in a November 2008 report.

CARB released a Version 2.0 of the soybean biodiesel lifecycle analysis on Jan 20, 2009. This version incorporated two of the NBB comments from the November 5, 2008 report on the version 1.0 document, the lower energy requirements for soybean crushing and the allocation of the fossil carbon to the glycerine rather than a portion to the biodiesel. These two changes, along with other changes that CARB made to the GREET model resulted in a reduction of GHG emissions from 35.26 g CO_2eq/MJ to 26.93 g CO_2eq/MJ. The ULSD has a carbon footprint of 95.3 g CO_2eq/MJ so the soybean biodiesel yields a 71.7% reduction in GHG emissions without indirect land use change.

In the NBB November report there were seven recommended changes and while most of the recommendations are relatively minor, one of the remaining recommendations is very significant, the calculation of co-product credits. Additional information is presented supporting the NBB position taken in the November report and not yet accepted by CARB.

The energy allocation approach is a valid means of allocation energy and emissions between the oil and the meal in the soybean system. However, the default value in GREET for the energy content of the meal is not an appropriate value and the GREET approach is inconsistent with that used by regulators in other regions of the world.

The energy content of soybean meal in the California version of GREET should be increased from 4,246 BTU/lb to 7,105 BTU/lb. This is still a conservative assumption but it will reduce the well to pump GHG emissions for the soybean biodiesel pathway to about 20.57 g CO_2eq/MJ. This will produce a well to wheel emissions rate of 21.35 g CO_2eq/MJ and a 77.6% reduction in GHG emissions before any possible indirect land use change emissions.

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1. INTRODUCTION

Climate change advocates point to increased levels of anthropogenic carbon emissions as the primary cause of global warming. As such, most greenhouse gas mitigation strategies are focused on reduction of carbon dioxide (CO_2) in the atmosphere. Since typically 30-40 percent of all carbon emissions are derived from mobile sources, automobiles and off-road equipment serve as focal points for many of these policies.

California has taken a lead in North America of promoting, developing, and implementing a Low Carbon Fuel Standard (LCFS) for transportation fuels. The concept is that the effective carbon content of transportation fuels will be reduced by 10% by the year 2020. The means of achieving this reduction will be left to the marketplace but the benefits of all of the fuel options will be determined through a lifecycle assessment of each fuel. Other states and some Canadian provinces have announced plans to follow California's lead or are considering doing so.

The California Air Resources Board (CARB) has begun to release a series of papers, each one covering a fuel production pathway, and inviting comments on the results and findings of the California GREET model. A report covering the soybean biodiesel (esterified soyoil) was released on October 3, 2008. The National Biodiesel Board submitted a number of comments on the initial version of the soybean biodiesel pathway in a November 2008 report.

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In the NBB November report there were seven recommended changes and while most of the recommendations are relatively minor, one of the remaining recommendations is very significant, the calculation of co-product credits. In this report we provide additional information to support the original recommendation of using the calorific energy content of the soybean meal rather than the metabolized energy content.

2. ALLOCATION ISSUES

Many systems produce multiple products and there is a need to allocate the emissions associated with the inputs and the process to the various products. Allocation in LCA is therefore carried out to attribute shares of the total environmental impact to the actual product, service, or production facility under focus. The ISO definition of allocation is:

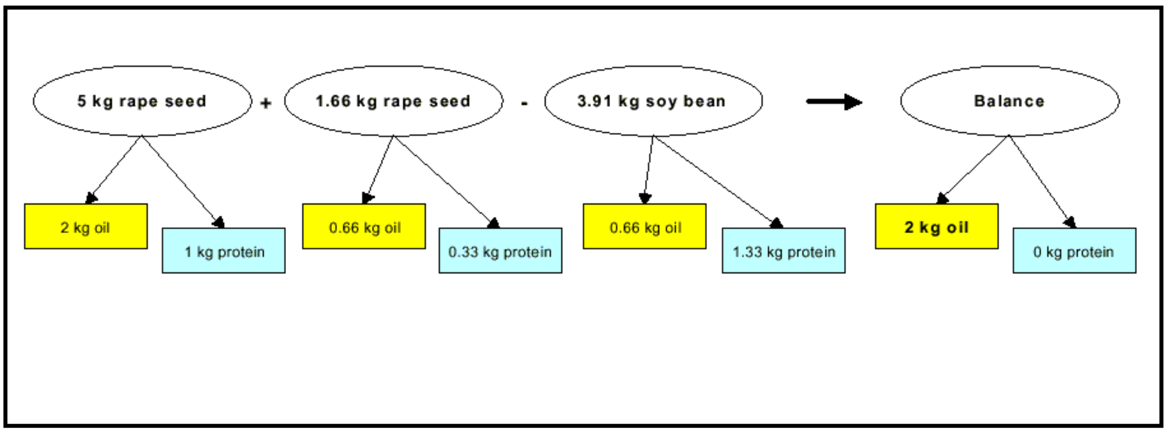
”Partitioning the input or output flows of a unit process to the product system under focus”.

There are two fundamental approaches to undertaking the allocation:

1. System expansion: Avoiding problem by expanding scope of analysis to include “other” flows
2. Partitioning: Method to apportion impacts between life-cycle under analysis and “other” flows

The preferred method is system expansion but it is not always possible to do this. In this approach the system is either divided into multiple steps where the inputs and outputs can be measured without allocation or by expanding the system to include the analysis of multiple products. This can be done with soybeans and canola (or rape) as shown in the following figure. In this case, by expanding the rapeseed system to include soybeans (or a soybean system to include rape), a system can be devised that only produces oil and thus no allocation would be necessary.

Figure 2-1 Soybean System Expansion



Very few transportation fuel LCA tools follow this approach since it requires both the rape (or canola) and soybean system to be included in the model. The GHGenius model does use this approach. This results in 37 % of the emissions of growing and crushing soybeans being attributed to the oil. The allocation between the oil and the meal can vary depending on the relative emissions in the rapeseed and soybean systems and can thus change over time and in different regions.

If system expansion cannot be carried out then there are a variety of other methods that can be used to perform the necessary allocation. The method that is generally preferred by LCA practitioners is the displacement method, but as LCA tools are being adapted for use in policy development or regulatory uses, some of the other approaches are being used.

- Allocation by energy displaced by substituting co-product for conventional (fossil-fuel derived) product.
- Allocation by co-product energy content.
- Allocation by co-product weight.
- Allocation by co-product market value.
- Allocation by share of process energy consumed to make co-product.

The GREET model allows users to choose between allocation methods. In the soybean pathway there are three choices, displacement, energy, and market value (there is a fourth hybrid approach but is gives the same answer as the displacement approach). The CARB approach is to use the energy allocation method for soybean biodiesel. Interestingly the approach for corn ethanol is to use the displacement approach. There is some lack of consistency in the approaches being used by CARB, whereas other jurisdictions have tried to apply consistent allocation procedures to all transportation pathways wherever possible.

2.1 ENERGY ALLOCATION PRECEDENTS

A number of European countries have developed LCA for biofuels and have developed default values for the systems. The UK, the Netherlands, Germany and the EU are among those that have studied the biofuel pathways. The UK and the Netherlands initially chose the displacement approach but then the EU and Germany signalled that they preferred the energy allocation methods and so there was a movement to harmonize the approaches.

The reason that the energy allocation approach was chosen by the EU was that it was deemed to provide the fewest unintended consequences. It was viewed that there may be an incentive to choose unsustainable practices that gave large GHG emission reductions if the displacement method was chosen.

The Dutch and German methodologies and documentation are publicly available. The UK has not updated its public model for the soybean biodiesel pathway to the energy allocation approach and the EU has just released the % reductions for each pathway (using very conservative default values).

Dutch GHG Emission Calculator:
http://www.senternovem.nl/mmfiles/BiofuelsGHGcalculatorv2%2E1_tcm24-280124.xls

Dutch Documentation:
http://www.senternovem.nl/mmfiles/Technicalspecificationv2%2E1b20080813_tcm24-280269.pdf

German Documentation:
http://www.oeko.de/service/bio/dateien/en/methodology_for_biofuels_defaultvalues_ifeu.pdf

The following table provides a comparison of the details of the energy allocation inputs and results for California, Germany, and the Netherlands. The Dutch and German values are identical and assume a moisture content of the meal of 18.6%. This is too high for North America, as Dairy One report an average moisture of 10% based on 5,152 samples over the past eight years.

Table 2-1 Summary of Energy Allocation Details

	Netherlands	Germany	California
Oil Energy Content (metric units)	36.6 MJ/kg	36.6 MJ/kg	
Oil Energy Content (imperial units)	15,700 BTU/lb	15,700 BTU/lb	16,000 BTU/lb
Meal Energy Content	15 MJ/lb	15 MJ/lb	
Meal Energy Content @18.6% moisture	6,426 BTU/lb	6,426 BTU/lb	
Meal Energy Content @10% moisture	7,105 BTU/lb	7,105 BTU/lb	4,246 BTU/lb
% Allocated to Oil at 18.6% moisture	35.2	35.2	
% Allocated to Oil at 10% moisture	32.3	32.3	45.7%

It can be seen that there is a significant difference between the California energy allocation and the European calculation. This is caused by the Europeans using consistent thermal energy contents for oil and meal and California using two very different measures of energy for the two products. This difference causes a large difference in the GHG emissions allocated to soybean biodiesel compared to soybean meal.

The Dutch report references the German report as its source and the German report has no reported source. A search for the "gross energy soybean meal" shows several references that report 4,200 kCal/kg (7,550 BTU/lb). These include

University of Georgia. http://www.poultry.uga.edu/soybeans/metabolize.htm

Brazilian Journal of Poultry Science. http://www.scielo.br/pdf/rbca/v6n3/a03v6n3.pdf

Some references are higher and may be due to how much oil is left in the meal.

FAO (10,170 BTU/lb) and the World Bank, (9,990 BTU/lb).

Romania Institute of Biology and Animal Nutrition (8,450 BTU/lb).
http://www.ibna.ro/AZ6/19%20Monica%20Parvu.pdf

2.2 Logic Issues

The use of metabolized energy for the meal is presumably based on the fact that this is the energy that the animal actually receives, the remaining energy in the meal that the animal was not able to metabolize ends up in the manure. An extension of this logic would suggest that the energy in the oil, since it is used for transportation fuel, should be the energy that is delivered to the wheels of the vehicle since that is what the vehicle can use, the remaining energy is dissipated to the environment mostly through heat in the exhaust or heat lost through the radiator similar to the energy in the manure being dissipated to the environment. This approach would put the net realized energy in the oil probably at about 5,000 BTU/pound. On this basis the allocation to oil would drop to 20.8%.

2.3 Other Allocation Results

The GHG emissions for biodiesel can be compared using the three allocation methods in GREET. For the energy allocation in the following table we show the results for both the thermal energy content (using German value adjusted to 10% moisture) of the meal and the metabolized energy content (from GREET), for the market allocation we will show results for the default market values in GREET and the Current market prices, The December version of the California GREET model is used and has been modified to include the reduced energy consumption in soybean crushing. There are probably other changes in the model that are not included which account for the slight difference between these numbers and those in the document.

Table 2-2 Comparison of GREET Allocation Options

	Well to Pump, g CO_2eq/MJ
Displacement Method	-9.26
Energy Allocation, current value	27.70
Energy Allocation, thermal energy for meal (German value)	20.57
Market Value Allocation, GREET defaults	27.76
Market Value Allocation, current market values	22.66

It can be seen that the current GREET model produces quite a wide range of values between the different allocation methods, with the displacement method (usually the preferred approach producing negative results). The energy and market allocation approaches provide similar values both with the default GREET values and with the energy inputs corrected for the meal energy content and the current market values for oil and meal.

For most biofuel pathways using the energy allocation approach provides more favourable results than the displacement approach. This is not the case here, the allocation used by CARB is the least attractive of the approaches. While we don't disagree with the use of energy allocation for regulatory means we do think than a more appropriate value of the energy content of the meal must be used.

3. RECOMMENDATION

The energy allocation approach is a valid means of allocation energy and emissions between the oil and the meal in the soybean system.

The default value in GREET for the energy content of the meal is not an appropriate value and the GREET approach is inconsistent with that used by regulators in other regions of the world.

The energy content of soybean meal in the California version of GREET should be increased from 4,246 BTU/lb to 7,105 BTU/lb. This is still a conservative assumption but it will reduce the well to pump GHG emissions for the soybean biodiesel pathway to about 20.57 g CO_2eq/MJ. This will produce a well to wheel emissions rate of 21.35 g CO_2eq/MJ and a 77.6% reduction in GHG emissions before any possible indirect land use change emissions.

4. REFERENCES

Dairy One. Main Library. http://www.dairyone.com/Forage/FeedComp/disclaimer.asp