October 15, 2014

Katrina Sideco
Air Resources Engineer, Fuels Section
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Dear Ms. Sideco,

Canergy, LLC is planning to construct and operate a cellulosic ethanol biorefinery in Imperial County, California. Canergy's primary feedstock will be a deducted feedstock, energy cane which is an approved EPA cellulosic feedstock. Energy cane is a perennial which is a highly fibrous form of sugarcane, whose high content of cellulose (glucose or C6 sugar), hemicellulose (xylose or C5 sugars) can be extracted using a conversion technology and turned into a very low carbon ethanol fuel. Canergy will produce up to 36 million gallons per year (MGY) of ultra-low carbon ethanol. The facility will be using second-generation technology conversion technology called PROESA™, which is licensed to Canergy by BetaRenewables SpA, and already used and tested in both Italy and Brazil on a commercial scale.

When using agricultural feedstocks to produce transportation fuels, it is imperative to include the effects of land use change (LUC) in quantification of GHG emissions. LUC emissions result when an existing crop is diverted from food to fuel production or when the type of plant grown on an existing plot changes. In this case, an existing crop in the Imperial Valley will be replaced with energy cane to be used for transportation fuel production. The existing crop will need to be replaced with new cultivation elsewhere. The replacement crop(s) will likely induce GHG emissions associated with clearing land and cultivation.

ARB's public workshop on September 29th, 2014 included a discussion of the importance of modeling land use change (LUC) impacts from biofuels. Canergy is very supportive of the need to include these impacts in the Low Carbon Fuel Standard (LCFS) calculations of carbon intensity (CI). We would like to take this opportunity to point out some important considerations for accurate modeling of energy cane LUC.

Data on LUC for energy cane and other small-scale specialty crops is not currently available in GTAP, the predominant modeling tool used in LCFS calculations. The ARB has previously committed to addressing specialty crops such as sugar beets and energy

cane. However, ARB seems focus their analysis on adaptations to the GTAP model, which may be to aggregate in scale to address new energy crops.

As the timing for the re-adoption of the LCFS comes closer, we are increasing concerned about the uncertainty of not having an LUC value that reflects energy cane grown in the Imperial Valley of California. ARB has not presented options for determining the LUC for energy cane.

One option would be to use the sugarcane LUC as a proxy for energy cane. Another option would be to find another source of data with which to model energy cane LUC impacts. With regards to the first option, the CI for Brazilian sugarcane is not an appropriate proxy for the LUC for energy cane to cellulosic ethanol. While energy cane and sugarcane might at first appear to have similar pathways, it should not be assumed that the land use changes associated with Brazilian sugarcane to ethanol production is an accurate proxy for Canergy's LUC implications in Imperial Valley. For one, the two crops exhibit a large difference in yields (see point 1). For another, the two crops are unlikely to displace the same crops in direct LUC impacts (see point 2).

1. **Ethanol Yield per Hectare of Crop**

   One of the major determinates of LUC impact is the amount of land required to produce a given amount of final product. Brazilian sugarcane and Imperial Valley energy cane production have very different yields. The yield of ethanol produced per hectare farmed will actually be three times greater using the Canergy production process than it is in the Brazilian sugarcane scenario. In other words, *a 500 gallon per acre ethanol yield in Brazilian production would be equivalent to a 2000 + gallon per acre yield for Canergy*. This difference is due to the high fiber sugar content of energy cane as well as the efficiency of the Canergy production process. Hence, any land use changes that result from Canergy's process will be at least one third as large as the LUC impacts associated with Brazilian sugarcane processing.

2. **Land Use Change Location and Displaced Crop Assumptions**

   A second major consideration is where land use changes are most likely to occur, and what those changes will be. Since energy cane is not an agro-economically traded crop, it will not have indirect LUC impacts since there is no reason to assume it is being grown elsewhere except for fuel production purposes. Therefore, only the direct LUC impacts need be modeled, i.e. the impact on crops that would otherwise be grown on the land that the energy cane will be grown on.

   California's Imperial Valley is located east of San Diego County and north of the California-Mexico border. Through extensive irrigation from the Colorado River, the Imperial Valley is an important part of California's farming industry producing nearly $2 billion in farming revenues in 2011 (Imperial County, 2011). Figure 1 displays the planted acres and value for each of the crops grown in 2011 and Figure 2 consolidates these data into hay, wheat and row crops. As can be seen, 25 percent of the acreage is dedicated to high value row crops with 75 dedicated to wheat and hay which garners less than one fifth of the revenue of row crops.

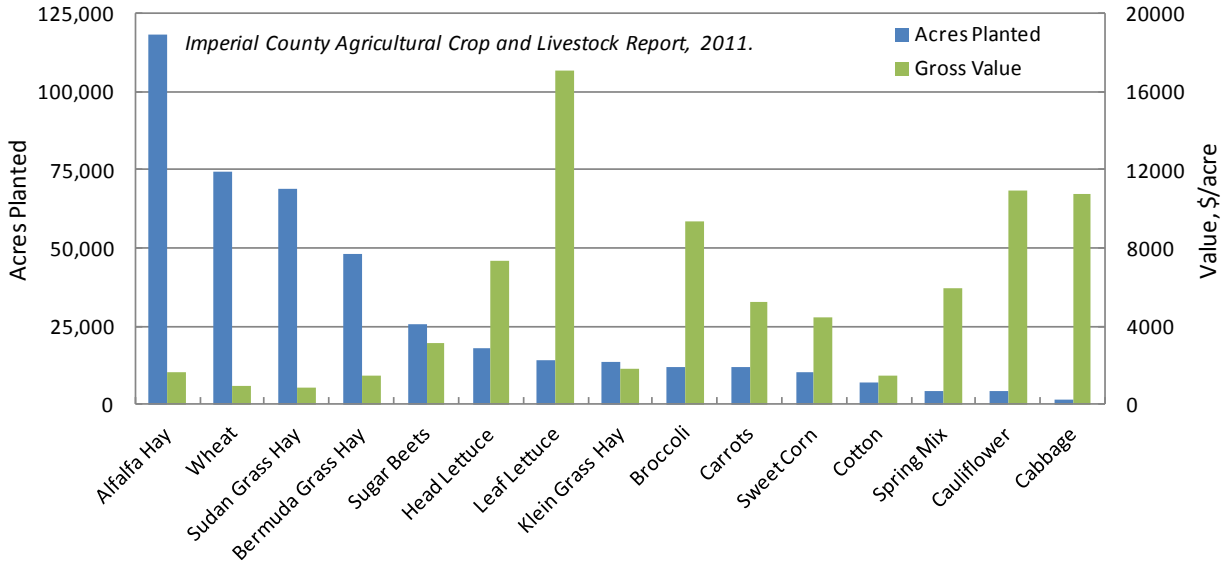

Figure 1. Planted Acres and Revenue for 2011 Imperial Valley Crops.

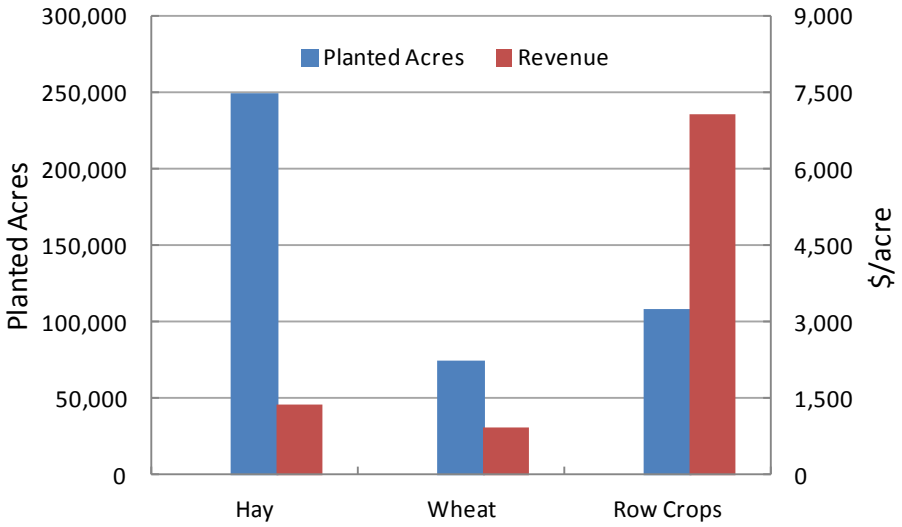

Figure 2. Summary of 2011 Imperial Valley Planted Acres and Revenue.

Canergy's research into crop production in this area has shown that the energy cane will be mostly replacing Sudan grass hay or land that is idled due to lack of a profitable commodity. Sudan grass is a nutrient intensive crops that deplete the soil and require the addition of large amount of fertilizer. Sudan grass is then exported instead of being used locally and remaining part of the domestic supply. Energy cane, on the other hand, improves the quality of the soil because of the significant root mass that remains in the soil after harvesting, increasing both the nutrient and organic carbon content of the soil. Canergy's products are also kept in the domestic market, unlike the Sudan grass it replaces. In contrast, Brazilian sugarcane is assumed to displace a mix of corn, oil seeds, and grains.

Water for crop production in Imperial Valley comes from the All American Canal. The farmers have historical water rights from the canal and continued farming in the

Imperial Valley is essential for the ongoing maintenance of the Salton Sea. Agricultural run-off is the primary source of water for this desert lake, which is a food source for migratory birds. Energy cane uses no more water than Sudan grass, or any other crop grown in the region.

For these reasons, Canergy recommends that ARB develop new data and modeling assumptions for specialty crops that are specific to the pathways in question. ARB's analysis of energy cane should take into account the biomass and fuel produced per acre, the root storage from energy cane, which is proportional to the biomass production and can be as high as 35% of the above ground biomass, and the displacement of crops in the Imperial Valley such as idle land, Sudan grass and others.

Differences in land use change impacts between one producer or location and another may be significant. It is important that estimated impacts from LUC be assigned an accurate and suitable value for a given crop, and must be tailored to the situation in the case of specialty crops such as Imperial Valley energy cane. We encourage ARB to consider these comments as it moves forward with developing guidelines and modeling assumptions for land use change implications. Please let me know if you have any questions.

Thank you for your consideration.

Sincerely,
Tim Brummels, CEO
Canery, LLC