Proposal for Biobased Industry Center Grants Program

Project Title: Impacts of Using Corn Stover for the Cellulosic Ethanol RFS on US and World Agricultural Commodity Markets, Land Use, and GHG Emissions

Project Leadership

<table>
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<tr>
<th>Name (PI/Co-PI)</th>
<th>Department</th>
<th>Phone No.</th>
<th>E-mail</th>
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<tbody>
<tr>
<td>Jacinto F. Fabiosa</td>
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Research Priority Addressed by this Project:

The 2007 EISA policy target is clear - 16 billion gallons (bg) of cellulosic ethanol. Of which, 5.7 bg can come from agricultural residue, primarily (i.e., 86%) corn stover, 7.9 bg from dedicated energy crops (e.g., switchgrass), and 2.4 bg from other feedstocks. If and when conversion technology is made commercially available, then a cellulosic ethanol sector can emerge in the US and expand to meet the RFS. What is not certain is its impacts on US and world agricultural markets, on land use, and on GHG emissions.

This study will focus on two key policy priority issues identified by BIC’s industry partners, in the following order of priority: 1) Impact of Bioenergy policy on broader agricultural markets and other biobased industries. We will assess the interactions of the bioenergy policy on cellulosic ethanol and feedstock markets. In particular, supply and utilization of corn stover and switchgrass feedstock are modeled such that prices, production, and use will be determined by market fundamentals and will impact the rest of the US and world agricultural sector. 2) Environmental Impacts of Biobased Industries and their implications for Regulatory and Economic Incentives. Even if corn stover is not directly land competing, as assumed in the EPA analysis, because it increases the revenue of corn production, it will have land use impacts. For example, corn grain ethanol and corn stover ethanol will be perfect substitutes in the demand side, but they will be complementary in the supply side because they are joint products. As more cellulosic ethanol enters the market, ethanol price will be softened and will adversely impact production of grain ethanol. However, as more corn production is encouraged with improved value of corn stover, supply of corn grain improves as well, thereby, exerting a downward pressure on corn grain price, and offsetting the adverse movement of ethanol price and its negative impact on profitability, as a result. The offsetting impacts can not be netted out a priori, but is an important empirical question to examine. Moreover, it is suspected that extraction of corn stover for cellulosic ethanol production may compromise land fertility and productivity, leading to land use impacts. That is, either more land is now needed to produce a given amount of corn, or more fertilizer needs to be applied to substitute nutrients lost in the extraction of corn stover for cellulosic ethanol production. In any case, the direction and magnitude of GHG impacts is not obvious.

Objectives

The general objective of the study is to assess the impact on US and World agriculture of imposing the 16 bg cellulosic ethanol RFS by 2022. Specifically, we will assess the impacts on

1. Ethanol prices, RIN values, production, consumption, and trade
2. Feedstock (corn stover, switchgrass) prices, production, and use
3. Food and feed grain prices, production, use, and trade
4. Livestock, poultry, and dairy prices, production, consumption, and trade
5. Food security of developing countries
6. Land use change by country by commodity
7. GHG emissions

**Approach**

We will use the FAPRI models for this analysis. FAPRI models are econometric, non-spatial, partial-equilibrium models that cover 61 countries/regions and 25 commodities. A baseline run where cellulosic ethanol RFS is waived is compared to a scenario run where the RFS is fully enforced. Recent FAPRI model developments position the FAPRI models for this type of analysis. For example, FAPRI now has an explicit specification of a cellulosic ethanol sector. Blender’s demand for cellulosic ethanol is a behavioral equation. On the supply side, cellulosic ethanol is specified by a capacity formation equation and capacity utilization equation, which are expressed as functions of net revenue. Both capacity equations then determine the derived demand for feedstocks, including corn stover and switchgrass. The supply for corn stover feedstock, on the other hand, is represented with an extraction rate expressed as function of net revenue from corn stover. The supply of switchgrass follows the same specification (with area and yield equations) as the other crops in the model. Both the cellulosic ethanol price and feedstock prices are determined in a market clearing mechanism. Also, FAPRI now has a fertilizer sector. This sector has been added to endogenize the rate of fertilizer application by nutrient (N-P-K), by crop, and by country. As a result, cost of production per acre is also now endogenous. For this analysis, we will link the rate of fertilizer application to the rate of extraction of corn stover to compensate for any loss of fertility with higher extraction. Finally, coupled with FAPRI’s GHG accounting model, we will now be able to accurately quantify the impact of the cellulosic ethanol RFS on GHG emissions through the land use impacts, livestock and dairy production impacts, and impact on fertilizer use.

**Workplan and Schedule**

- Literature review: August 2011
- Model development (e.g., linking fertilizer use with corn stover extraction): September 2011
- Baseline run of the models (cellulosic RFS is waived): November 2011
- Cellulosic RFS scenario run of the models (RFS enforced): January 2011
- Analysis of results: March 2011
- Report write-up: June 2011

**Budget** (indirect not allowed)

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<tr>
<th>CATEGORY</th>
<th>AMOUNT REQUESTED</th>
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<tr>
<td>Salaries @ $7,791.66/month for 1.5 months for PI</td>
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<td>Benefits @ 33.3% of salary</td>
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<td>PhD Student @ $1,600/month half time for 12 months</td>
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<td>Supplies &amp; Services (includes $2,500 for PC upgrade)</td>
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<td>Travel (airfare, lodging, meals for 3 days prof meeting)</td>
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<td>Publication (one article in referred journal)</td>
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<td>Miscellaneous* @ $150/month/full time equivalent</td>
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<td><strong>TOTAL</strong></td>
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*Includes telecomm, computer use, print/copy, honoraria, services/user fees, postage, etc.*
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Education:
B.S., Agribusiness, University of the Philippines at Los Banos, Philippines, 1978
M.S., Agricultural Economics, Michigan State University, East Lansing, MI, 1983
Ph.D., Agricultural Economics, Iowa State University, Ames, IA, 1993

Areas of Concentration:
International Trade, Consumption Economics, Price Analysis, Econometrics

Professional Experience:
Scientist (2007-present) Co-Director FAPRI, CARD, ISU
Research Fellow (1988-1989), International Rice Research Institute, Philippines

Project Experience:
Co-Principal Investigator, EPA LCA for RFS2, 2008-2010.
Principal Investigator, Assessing the Supply and Utilization of Grain and Meat in Indonesia.
National Research Initiative, USDA, 2000-2002
Co-Principal Investigator, Cost of Production, Productivity, and Comparative Advantage of Feed and Livestock Industry: Comparison of Midwest of the United States and Six Regions of China, Midwest Agribusiness Trade Research and Information Center (MATRIC), 2002

Recent Publications: Refereed Journals, Working Papers, and Magazines
Fabiosa, J.F., 2008, “Not All DDGS Are Created Equal: Nutrient-Profile-Based Pricing to Incentivize Quality”, CARD 08-WP 481