Office of Agricultural Affairs
U.S. Embassy, Paris

Biobased Products in the United States Newsletter – December 2009

To our readers: The Office of Agricultural Affairs of the U.S. Embassy in Paris would be happy to help answer questions you may have concerning the information below, including facilitating contact with the organizations associated with the articles. Also, please do not hesitate to share any of your comments with us on the issues raised below.

For further information on all of the following topics, please click on the links to access websites.

1. U.S. Policy and Project Funding

• EPA Notifies Industry Group on Status of Ethanol Waiver Request [1]

On December 1, the U.S. Environmental Protection Agency (EPA) announced that it expects to make a final determination in mid-2010 regarding whether to increase the allowable ethanol content in fuel.

In a letter to Growth Energy – a bio fuels industry association that had asked EPA to grant a waiver that would allow for the use of up to 15 percent of ethanol in gasoline – the agency said that while not all tests have been completed, the results of two tests indicate that engines in newer cars likely can handle an ethanol blend higher than the current 10-percent limit. The agency will decide whether to raise the blending limit when more testing data is available. EPA also announced that it has begun the process to craft the labeling requirements that will be necessary if the blending limit is raised.

In March 2009, Growth Energy requested a waiver to allow for the use of up to 15 percent ethanol in gasoline, an increase of five percent points. Under the Clean Air Act, EPA was required to respond to the waiver request by December 1, 2009. EPA has been evaluating the group's request and has received a broad range of public comments as part of the administrative rulemaking process. EPA and the Department of Energy also undertook a number of studies to determine whether cars could handle higher ethanol blends. Testing has been proceeding as quickly as possible given the available testing facilities.

Full text of the letter: http://www.epa.gov/otaq/additive.htm

• Reactions from the Ethanol Industry:
- Growth Energy Welcomes EPA Letter on E15[2]

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[1] http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/a4a8c42f54552d3c8525767f00515ded!OpenDocument

[2] http://www.growthenergy.org/2009/news/showItem.asp?id=111

Growth Energy, the coalition of U.S. ethanol supporters that filed the Green Jobs Waiver seeking E15, described as a "strong signal" the Environmental Protection Agency's announced that it was preparing to approve E15 upon the completion of ongoing tests early next year. This announcement is a strong signal that we are preparing to move to E15, a measure that will create 136,000 new U.S. jobs, cut greenhouse gas emissions and lessen America's dependence on imported oil.

The Growth Energy Green Jobs Waiver brought to light the issue of the regulatory cap on ethanol and is responsible for moving this process forward. The importance of increasing the blend is now universally understood. Moving to E15 provides much-needed market opportunity for the domestic ethanol industry by adding seven billion new gallons of market potential. This expanded market opportunity is necessary to draw capital investment for cellulosic ethanol and allows the industry to comply with the Renewable Fuel Standard. EPA is also to be commended for its intent to begin the labeling and public education process sooner rather than later; this decision means we could begin to move to E15 as soon as engine testing is completed in the spring.

Reaction of the Renewable Fuels Association: EPA Delay Threatens Continued Evolution of American Biofuels Industry [3]

This delay threatens to paralyze the continued evolution of America's ethanol industry. As EPA itself indicated, the scientific data to date has demonstrated no ill-effects of increased ethanol use in any vehicle currently on the road. Moreover, this delay will chill investment in advanced biofuel technologies at a critical time in their development and commercialization.

In order to avoid paralysis by analysis, EPA should immediately approve intermediate ethanol blends, such as E12. Allowing for a 20 percent increase in ethanol's potential share of the market would provide some breathing room for the industry while EPA finishes its testing on E15. Additionally, it would represent a good faith gesture that underscores the commitment President Obama has pledged to biofuels.

Beyond the delay, another worrisome development is EPA's apparent decision to limit the scope of its waiver research to vehicles model year 2001 and newer. The data to date has shown no ill-effects of increased ethanol use in any vehicle, regardless of model year. The RFA encourages EPA to look at the waiver request with the entire range of vehicles in mind or provide detailed, scientific rationale for excluding older model vehicles.

National Corn Growers Association: EPA's Non Decision on Higher Ethanol Blends[4]

The Environmental Protection Agency's decision not to decide on a waiver that would allow up to 15 percent ethanol blends in regular gasoline leaves the ethanol industry in limbo for at least another six months. While the agency seemed to indicate that it will approve the waiver, once they "have all the necessary science to make the right decision," they only said it would apply to year 2001 and newer vehicles. That would mean only 60 percent of American cars and trucks could use the fuel, which sounds like the making of a nightmare for fuel retailers.

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[3] http://renewablefuelsassociation.cmail3.com/T/ViewEmail/y/74128E029A912ABD

[4] http://corncommentary.com/2009/12/06/epas-non-decision-on-higher-ethanol-blends/

2. Upcoming Conferences

- **March 30-31, 2010: U.S. Department of Energy – Energy Efficiency and Renewable Energy - Biomass 2010[5]**

Building on topics explored at past conferences, ***Biomass 2010*** will focus on the role of biomass in our nation's energy portfolio and address important issues like sustainability, infrastructure, and rural development. The technical program will feature more than 60 speakers offering diverse perspectives on ways to make sustainable biofuels, biopower, and bioproducts a key part of the Department's strategy for secure and clean energy.

For information about last year's conference, including presentations and a list of attendees, visit the Biomass 2009 Web page.

February 8-10, 2010: Biobased Chemicals Summit[6]

The era of bio-based chemical products has arrived. Oil prices have risen sharply and may be headed even higher. Chemicals derived from biomass are now getting market share in the $3 trillion world chemicals industry. The Next Generation Bio-Based Chemicals Summit will be the first event to bring together all the communities needed for this nascent industry to mature. Leaders from global oil and chemical strategics, strategic and venture investors, biotech start-ups, feedstock suppliers/sources, tool vendors, and project developers (algae, biodiesel, ethanol, biobutanol), pulp and paper mills, utilities and manufacturers with CO_2 or organic waste streams will discuss:

- What conditions will be required for these cross-sectoral relationships to prosper?
- How have relationship-building efforts worked in the past, what have been the blockages, what are the successes?
- What are the wants, needs and perspectives of players across the entire value chain, and what types of deals and relationships are they open to looking forward?

3. Economic Reports

USDA – Office of the Chief Administrator: Energy Life-Cycle Assessment of Soybean Biodiesel[7]

[5] http://www1.eere.energy.gov/biomass/biomass2010/printable_versions/index.html

[6] http://www.infocastinc.com/index.php/conference/246

[7] http://www.usda.gov/oce/reports/energy/ELCAofSoybeanBiodiesel91409.pdf

In September 2009, USDA published a report aiming to update the energy life cycle inventory (LCI) from the original published in 1998, which concluded to a fossil energy ratio of biodiesel to 3.2 (meaning biodiesel yields 3.2 units of energy for every unit of fossil energy consumed over its life cycle). The LCI of biodiesel in the current analysis includes four subsystems: feedstock production, feedstock transportation, soybean processing with biodiesel conversion, and biodiesel distribution. The Fossil Energy Ratio (FER), which is used in this study to measure the energy balance of biodiesel, is defined as the ratio of the energy output of the final biofuel product to the fossil energy required to produce the biofuel. Major changes observed since the 1998 include: (1) the increased adoption of no-till practices by soybean farmers (reducing fuel requirements); (2) the widespread adoption of genetically engineered soybeans by farmers (soybean yields have been improving over time because of new seed varieties, improved fertilizer and pesticide applications, and new management practices); and (3) the improved energy efficiency of recently built soybean crushing facilities.

Both direct and indirect energy requirements for producing soybean were considered. The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model for transportation was used. A processing facility that combines a soybean processing plant with a biodiesel conversion unit producing 9.8 million gallons of biodiesel, 151,515 tons of soybean meal, and 9,000 tons of soybean hulls, and 4,380 tons of crude glycerin was used in the model. Also, secondary energy inputs (farm machinery, building materials for the crushing and biodiesel conversion plants) were added to the 1998 model. The estimated FER was 4.40, considerably higher than the 3.2 found in 1998. Further, the analysis found that the FER of soybean biodiesel is expected to reach about 4.69 when projected soybean yield reaches 45 bushels per acre in 2015.

USDA – Economic Research Service: Ethanol and a Changing Agricultural Landscape[8]

The Energy Independence and Security Act (EISA) of 2007 established specific targets for the production of biofuel in the United States. Until advanced technologies become commercially viable, meeting these targets will increase demand for traditional agricultural commodities used to produce ethanol, resulting in land-use, production, and price changes throughout the farm sector. This report summarizes the estimated effects of meeting the EISA targets for 2015 on regional agricultural production and the environment. Meeting EISA targets for ethanol production is estimated to expand U.S. cropped acreage by nearly 5 million acres by 2015, an increase of 1.6 percent over what would otherwise be expected. Much of the growth comes from corn acreage, which increases by 3.5 percent over baseline projections. Water quality and soil carbon will also be affected, in some cases by greater percentages than suggested by changes in the amount of cropped land. The economic and environmental implications of displacing a portion of cornethanol production with ethanol produced from crop residues are also estimated.

USDA – Economic Research Service: Full Throttle U.S. Ethanol Expansion Faces Challenges Down the Road[9]

There are ethanol demand challenges: Future growth in U.S. ethanol demand will be constrained by policies regarding allowable ethanol blends as well as characteristics of current gasoline motor vehicles, factors that are highly related. Under current U.S. policy, ethanol is permitted to be blended with gasoline in mixtures up to 10 percent ethanol (E10), by volume, or 85 percent ethanol (E85). Midlevel blends with

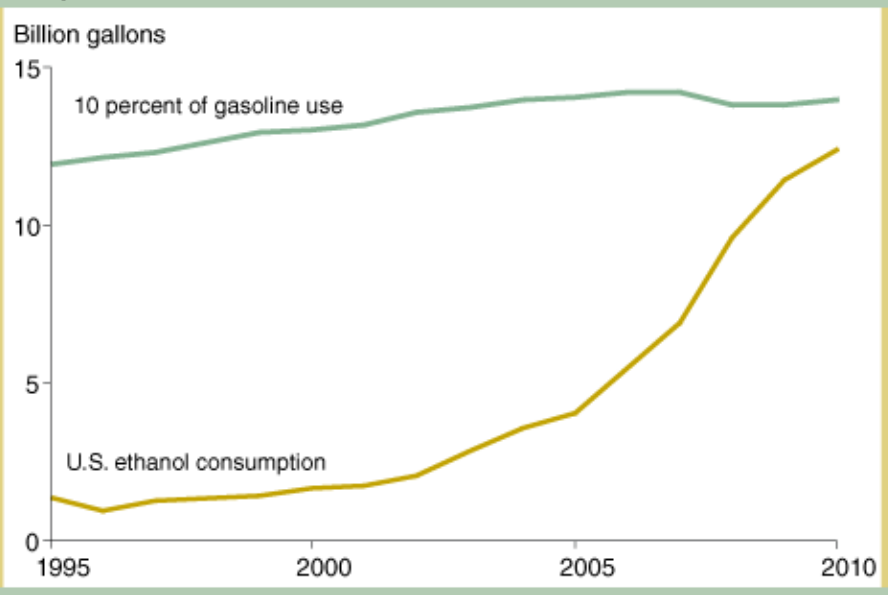
[8] http://www.ers.usda.gov/Publications/ERR86/

[9] http://www.ers.usda.gov/Amberwaves/September09/Features/EthanolExpansion.htm

ethanol content above 10 percent but less than 85 percent are generally not permitted, except for use in flexible fuel vehicles.

Ethanol demand for E10 will hit the "blend wall" soon: Ethanol use of E10 is expected to be near its maximum levels within a few years, hitting the so-called blend wall, as E10 reaches its saturation point in the gasoline market. Annual gasoline use (including ethanol blends) in the United States peaked at about 142 billion gallons in 2007 before falling to just under 138 billion gallons in 2008 due to record-high gasoline prices and the economic slowdown. Future growth in gasoline consumption will be affected by the size of any post-recession rebound in gasoline use, longer term gains in gasoline demand, and improvements in fuel efficiency. Depending on the assumptions regarding growth in fuel demand and efficiency, gasoline use could range as high as 150 to 160 billion gallons in 2022. This suggests the E10 market will soon hit a maximum, with growth in subsequent years only reflecting increases in total gasoline use. Even if total gasoline use in 2022 reaches the high-end projection of 160 billion gallons, the maximum amount of ethanol that could be used in E10 would be 16 billion gallons--well short of the legislated RFS-2 of 36 billion gallons.

Ethanol expansion in the United States pushes use toward the 10-percent blend wall



Source: USDA, Economic Research Service using data from U.S. Department of Energy, Energy Information Administration and USDA.

E85 demand has a long way to go: With 10-percent ethanol blends expected to be nearing their saturation point, increased use of biofuels will depend on expanding the E85 market. Although E85 is used in corn- and ethanol-producing States such as Iowa, Missouri, and Minnesota, it is not widely available in most of the U.S. In particular, E85 is sold at only a few stations in most major population centers, where gasoline consumption is greatest. Currently, E85 accounts for less than 1 percent of the Nation's total gasoline use. Growth in the E85 market would require a larger number of flexible fuel motor vehicles, as well as an expanded distribution infrastructure to make E85 more widely available. Greater volumes of ethanol would need to be transported from ethanol plants to population centers, putting more demand on the rail and trucking infrastructure. Also, retail gasoline stations would need storage facilities and pumps that can accommodate E85, requiring significant investment. Many urban stations may lack the space needed to add E85 pumps.

4. Technical Studies

Sustainable Corn Production Supports Advanced Biofuel Feedstocks[10]

USDA/Agriculture Research Service (ARS) scientists have found that it might be more cost-effective, energy-efficient and environmentally sustainable to use corn stover for generating an energy-rich oil called bio-oil and for making biochar to enrich soils and sequester carbon. Stover is made up of the leaves, husks, cobs and stalks of the corn plant, and could provide an abundant source of feedstock for cellulosic ethanol production after the grain is harvested. But removing stover from the field would leave soil more vulnerable to erosion, deplete plant nutrients and accelerate the loss of soil organic matter.

Several ARS scientists collaborated with the National Corn Growers Association to explore other options for using corn stover as biofuel feedstock. The team used fast pyrolysis, which is rapid heating in the absence of oxygen, to transform corn stover and cobs into bio-oil and bio-char. They found that the bio-oil captured 70 percent of the total energy input, and the energy density of the bio-oil was five to 16 times the energy density of the feedstock. This suggests it could be more cost-effective to produce bio-oil through a distributed network of small pyrolyzers and then transport the crude bio-oil to central refining plants to make "green gasoline," rather than transporting bulky stover to a large centralized cellulosic ethanol plant.

In addition, about 18 percent of the feedstock was converted into bio-char, which contains most of the mineral nutrients in the corn residues. Using biochar as a soil amendment would return those nutrients to the soil, reduce leaching of other nutrients, help build soil organic matter and sequester carbon. These benefits would help mitigate the adverse environmental effects of harvesting stover for fuel production.

ARS Scientist Helps Craft National Academies Report on Alternative Fuels[11]

A scientist in USDA/Agricultural Research service (ARS) was a key contributor to a National Research Council report on the technical feasibility, costs, and environmental impacts of producing alternative transportation fuels. The report, “Liquid Transportation Fuels from Coal and Biomass: Technological Status, Costs, and Environment,” was the result of collaborations between 16 experts from public and private organizations and was released in May. It is the first of a series of studies to be released from the National Academies' “America's Energy Future” project, which was undertaken to stimulate and inform a constructive national dialogue about the nation’s energy future.

The report authors concluded that fuels from coal and biomass could help alleviate the U.S. demand for oil. However, significant technological investments will be needed to develop cost-effective and environmentally sound techniques for producing transportation fuels from coal and biomass.

ARS researcher was key contributor to the chapter on “Biomass Resources for Liquid Transportation Fuels.” The chapter provides an overview of how the proper management of lignocellulosic biofuels could contribute to U.S. energy security, support U.S. agriculture and rural communities and help protect the environment, all in a sustainable manner.

The report is accessible online at: http://www.nap.edu/catalog.php?record_id=12620

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[10] http://www.ars.usda.gov/is/pr/2009/091124.htm

[11] http://www.ars.usda.gov/is/pr/2009/090925.htm

The Field Narrows for Cover Crops in Biofuel Production [12]

An Agricultural Research Service (ARS) scientist is looking for cover crop perennials that provide the best balance in biofuel production between agronomic success and environmental sustainability. This work is being supported by the Sun Grant Initiative, a national network of land-grant universities and federally funded laboratories working together to study, produce, and commercialize renewable, biobased energy technologies.

ARS agronomist is conducting this research as part of a three-component study of optimizing corn cultivation for biofuel production. He's evaluating perennial grass crops to assess their potential for mitigating soil erosion and enhancing soil organic matter even in fields where every bit of corn and stover—stalk, leaves and all—is harvested either for grain or cellulosic ethanol production.

Results from ARS researcher's first season in the field indicated that white clover or Kentucky bluegrass were promising cover crop candidates worthy of additional study. On the other hand, creeping red fescue added notable amounts of carbon to the soil, but was very competitive with corn.

When the optimum groundcover has been identified, using no-till and strip-till cultivation practices in the corn-groundcover system will reduce the amount of fossil fuel needed to prepare and plant the crops. This reduced tillage, in turn, will decrease greenhouse gas emissions and require fewer energy inputs than using conventional tillage—another prospective plus for farmers and fields alike.

Inventors Offer Ecofriendly Substitutes for Polystyrene [13]

Rigid, custom-fit foam pieces like those that keep computer monitors firmly in place inside cardboard boxes during shipping could be made with eco-friendly starch from potatoes, wheat or corn, instead of from petroleum, according to Agricultural Research Service (ARS) research plant physiologist. Opting for starch in place of petroleum-derived polystyrene would lessen America's dependence on petroleum. Like those conventional foams, the biofoams can be manufactured to a range of densities and can be die-cut or molded into a seemingly limitless array of shapes, sizes and thicknesses.

Both patent-applied-for technologies for making biofoams rely on an extruder—a standard piece of equipment—to heat and mix starch and other all-natural compounds. With one option, the extruder squeezes out long strings, called "thermoplastic melt," that are later cut into small beads about half the size of a marble.

At various points in the process, the beads puff and expand, such as when they are put into the cavity of a heated mold to press them into the desired shape. Expanded beads eventually touch one another, creating a strong matrix that's much like the bead matrix of polystyrene foams.

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[12] http://www.ars.usda.gov/is/pr/2009/090923.htm

[13] http://www.ars.usda.gov/is/pr/2009/090917.htm

With Biobased Additives, ARS Scientists "Just Say No!" to Petroleum[14]

The U.S. demand for additives, already at nearly 2 billion pounds a year, is expected to increase 2 percent annually for the next five years. That projection might attract new interest in a process, developed several years ago by Agriculture Research Service (ARS), for making additives from plants instead of petroleum. These biobased additives would be suitable for use in formulating greases; engine oils; and hydraulic, transmission and drilling fluids. The additives could be made from the predominant fat molecules—triglycerides—in natural oils of familiar crops like soybean, corn or canola, or from lesser-known plants like camelina, crambe or pennycress.

Besides providing a potentially profitable market for growers in the Midwest and elsewhere, the fully biodegradable, new-age additives offer other benefits and, to date, no downside. Since they're fully biodegradable, proper disposal is fast, easy and inexpensive. They can be used with either biobased or conventional lubricants. The additives meet all the standard criteria for a top-notch, antifriction, antiwear additive–namely, impressive viscosity and liquidity, high flashpoint, and stability despite temperature extremes. In small-scale laboratory tests to evaluate wear and friction, the plant-oil additives performed as well as, or better than commercial petroleum-based additives.

New Yeasts Could Help Fast-Track Biofuel Production [15]

A new yeast that makes ethanol from both five-carbon and six-carbon sugars without needing oxygen has been developed by Agriculture Research Service (ARS). This could be an important breakthrough in industrial ethanol production, because it's difficult to control oxygen levels as yeasts ferment sugars into ethanol. The new yeast strain would help alleviate this problem.

Producers already make grain ethanol by using yeast to ferment six-carbon plant sugars like glucose. But cost-effective production of cellulosic ethanol will require using both six-carbon and five-carbon sugars in the process. ARS developed the first yeast strain that doesn't require oxygen to grow on xylose, a five-carbon plant sugar. The new yeast doesn't directly convert large quantities of xylose into ethanol. Instead, xylose provides energy the yeast needs to grow and reproduce without oxygen. This means that the glucose that might have been used by the yeast to grow and reproduce is now available for fermentation, and the rate of ethanol conversion increases.

ARS researcher developed a yeast strain containing a gene that makes an enzyme for converting xylose into ethanol, and added another gene to the strain so that the yeast could metabolize the xylose more efficiently. After screening yeast strains, researchers found five genes associated with the enzyme that converts xylose into ethanol, and confirmed that these five genes play a critical role in yeast cell growth.

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[14] http://www.ars.usda.gov/is/pr/2009/090903.htm

[15] http://www.ars.usda.gov/is/pr/2009/090728.htm