Advanced Biofuels USA, a nonprofit educational organization, advocates for the adoption of advanced biofuels as an energy security, economic development, military flexibility and climate change solution.

The Distributed/Centralized BioProduction Approach:
Sustainable Biofuels and Bioproducts Are Possible Through the Significant Reduction of Biomass Transportation Costs

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Problem Definition

The production of biofuels in the US is at a substantial roadblock. Due to the high cost of transporting large quantities of low density, low value biomass to biorefineries, the economies of scale that allow the US petroleum industry to minimize production and transportation costs are not available to the biofuel industry.

The current biofuel production paradigm is based on the "Midwestern Model" of building relatively small, 50-100 mgy (million gallons per year) biorefineries that are supplied by a single type of crop grown within the economic transport range for freshly harvested crops. The maximum range for cost-effectively transporting these crops is about 50-75 miles.

There are two significant problems with this approach.

First, in most agricultural areas east of the Mississippi there is not enough contiguous non-food producing land within the 50-75 mile zones suitable for biorefinery siting to "feed" a biorefinery of even the small 50-100 mgy size.

Second, and even more important, the current biofuel production system cannot economically sustain the 2-5 billion gallons/year biorefineries needed to cost-effectively meet US transportation fuel demands. (The average US *petroleum* refinery capacity is 1.7 billion gallons/year (146 refineries) and the ten largest *petroleum* refineries that supply 23% of all capacity average 5.5 billion gallons/year. US DOE/EIA 2008 data.)

Solution Definition

The solution to this problem is to efficiently convert harvested field crops, slash timber, and agricultural residues at their point of production into biofuel and bioproducts precursors with sufficient value so they may be economically transported in excess of 500 miles. At the end of their journey, these precursors would arrive at large-scale

biorefineries that would be designed to produce a variety of market driven bioproducts ranging from automotive fuel alcohols to structural polymers. In many cases, these large facilities would be co-located with existing petroleum refineries or would utilize mothballed industrial facilities.

The most efficient precursors that should be produced are soluble sugars or pyrolysis hydrocarbons. These slurry liquids can be transported by tank trucks, rail cars, or barges. Additionally, the composition and concentration of these slurries produce a product with enough value to justify medium to long-range transport.

Design Principles

The Decentralized/Centralized concept embraces two general concepts: Follow-the-Crop and Depot systems.

Follow-the-Crop: Developed by Atlantic Biomass Conversions, this portable system is based on the model of combines that follow the harvest season, “Follow-the-Crop” modules would be deployed nationwide as energy grasses and crops are harvested. These modules would convert the biomass into medium density soluble biofuel sugars, C-5 and C-6, using a fast, low-cost combined pretreatment and saccharification enzyme system. A byproduct would be high protein animal feed from the plant proteins. These systems would be especially beneficial to regions with non-contiguous stands, converted pasture lands, lands with regulated cropping patterns (conservation lands), or regions lacking in railheads equipped with grain elevators.

Depot: The Depot system, developed by Bruce Dale of Michigan State University, envisions a series of multi-precursor production systems co-located with existing agricultural collection points such as grain elevators. These systems would be able to produce pyrolysis hydrocarbons, as well as high protein animal feeds. These multiple crop input systems would be especially suited to regions with existing networks of agricultural collecting points with railheads since the Depots would be able to collect and process large quantities of biomass.

In either case, the benefits to overall bioproducts would be the same.

Decentralized/Centralized System Benefits

By splitting precursor production from the integrated biorefinery and placing it close to the grower, the transportation conundrum can be overcome. The result would be a sustainable biofuel and bioproducts industry. Benefits would include:

For Growers and Agricultural Communities

- Multiple crops and agricultural residues could be used as biofuel feedstocks giving growers multiple economically driven options.
- With biofuel feedstocks becoming non-crop specific, “energy” crops can be selected on the basis of specific environmental and agronomic factors rather than suitability for the local biofuel plant.
- Farmers will be able to utilize their marginal lands and expand their selection of crops for biofuel use without the necessity of planting hundreds of contiguous acres.
- Significant quantities of total energy biomass could be grown outside the Midwestern “grain-belt.”
- Nationwide deployment of the Depot and Follow-the-Crop systems would provide new, year-round employment in technical and equipment maintenance jobs needed to staff the biofuel intermediate production modules.
- Rural communities could retain significant biomass economic benefits from precursor production without having industrial biorefinery installations in their towns.

For the Bioproducts Industry

The Decentralized/Centralized concept would transform the American advanced biofuels and bioproducts industry into one coherent system that could respond to supply and demand market forces. Benefits to the industry would include:

- Changing the feedstock of biofuel refineries from individual specialized crops into common commodities would make input pricing stable.
- Providing common precursors on a year-round basis would increase the number of days of biorefinery operation. This would greatly improve the economics of biofuel production and make the industry a better investment.
- Providing common precursors would reduce and simplify refinery conversion operations leading to reduced production costs.
- Providing a reliable and sustainable biorefinery feedstock would encourage investments in new advanced biofuels and bioproducts.

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