Bioenergy Feedstock Production – Case Study

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The POET Project Liberty is a good example of the development of a sustainable and potentially profitable bioenergy feedstock production system. Even though POET is a major corporation, many of the principles that applied to the development of their biomass feedstock also apply to small scale producers. POET operates 27 biorefineries that produce starch-based ethanol and the company has the potential to develop biomass production facilities at many of the facilities. Further, there is considerable corn stover biomass resources located near POET's corn ethanol facilities.

Using existing infrastructure, POET plans to develop a pilot facility that will produce up to 25 million gallons of cellulosic ethanol and harvest and process 285,000 dry tons of cob bales. It plans to use lignin, the co-product of the cellulosic process, to produce biogas that will power both the cellulosic and starch-based ethanol facilities and will help minimize production costs. In the pilot facility, the company has focused on producing a value added product (cellulosic ethanol), developing a value added use for the co-product (lignin), and making strides to reduce costs of production. In addition, the company is improving the carbon emission associated with the corn ethanol facility by reducing the amount of natural gas needed for processing. Once POET demonstrates the concept at the pilot facility (dubbed *Project Liberty*), it plans to expand to other facilities and to license the technology to other ethanol plants, thereby creating another value added dimension to the system.

One of the challenges that POET faced is developing a value chain in which both the feedstock producer and the consumer profit. Overcoming this challenge began in 2007 and 2008 with a field trial of a cob-only harvest model. Eventually, the company worked with equipment manufacturers, farmers, and researchers at USDA and Iowa State to develop a system in which cobs and high cut materials are collected following the combine. The resulting EZ bale method (http://poet-dsm.com/resources/docs/Stover-Bale-vs-EZ-Bale.pdf) produces bales containing less ash and nutrients than conventional stover bales contain. The EZ bale method requires only two passes (combine and bale) compared to a traditional three-pass (combine, rake and bale) system. The EZ Bale system collects about 1 ton per acre or about 25% of the material available from a high yielding corn crop that is typical of Corn Belt environments. The system meets sustainability goals by leaving more than 2.5 tons of dry matter as residue and it minimizes nutrient removal—generally, it removes only potassium at an impact of about $5-8/acre.

POET has developed two pricing structures: one for when the farmer harvests the product and another if POET arranges for the harvest and the farmer receives only an access fee. The set prices are generally above production cost estimates found in the literature (Erickson and Tyner, 2010) of $54/ton with premiums for on-farm storage and two-year contracts. Custom harvest bids range between $20 and $22 with premiums for delayed delivery. Production cost estimates are based on collecting only cobs; with the large amount of biomass collection proposed in this system, production costs could be lower. Also, the new system eliminates the expensive cob collection unit proposed in initial assessments. The new system in which stover is collected following the combine rather than on the combine could reduce the potential for cob collection to slow grain harvest. Further, having a custom operator approach would allow the stover baling equipment to be amortized over more acres and would reduce the cost per ton compared to less efficient ownership models.

POET has also developed systems for satellite storage in which the main feedstock storage area holds about three weeks of material, which reduces the risk of fire and cost of storage. In addition, it is working with producers to develop methods of storage to minimize losses if delivery is delayed more than 6 months. For example, POET recommends tarping large square bales that will be delivered after April.

Growers report that the removal of some residue can reduce the need for tillage and, in some cases, improve corn yields. This has been supported by regional research by Iowa State (Birrell and Karlen, 2011). Anecdotally, farm youth who have become involved in harvesting and hauling operations have been able to stay on the operation. These benefits can be considered value added co-products of bioenergy feedstock production. POET suggests that grain yield improvement increases revenue by $20/acre and tillage savings is about $11/acre. It estimates the value of the residue at $25/acre (after collection cost) for a total revenue stream of $51/acre, or about $51,000 additional revenue for a 1000 acre corn-on-corn operation.

Through its Project Liberty pilot, POET has a plan for an operation that contains many attributes of a successful bioenergy feedstock production enterprise—attributes that smaller scale operations should consider. POET has targeted a valuable market in cellulosic ethanol and has established several valued added potential co-products including reduced tillage, higher yields, licensing potential, and lignin as a low carbon energy source. Where possible, the project uses existing infrastructure to keep production costs down. The company has documented the sustainability of the approach and has developed a pricing system that provides benefits to both the biomass producer and the consumer (POET). The modified harvesting system reduces costs and maximizes the potential biomass that can be harvested within sustainability constraints.

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