

## The Importance of User Facility Size and Biomass Feedstock Distribution in Determining Economic Viability

**Purpose:** The purpose of this analysis is to investigate the importance of user facility size (i.e., feedstock demand level) and biomass resource distribution around the facility to determine the delivered cost of biomass feedstock necessary to meet demand.

**Approach:** The study examines using corn stover as the sole biomass resource used to supply ethanol plants in Iowa. Ethanol plant demand levels are 500 dMT/day and 2000 dMT/day. Corn stover supply estimates assume a continuous corn rotation, reduced tillage practices (current mix of mulch and no-till), and simple representation of soil carbon and erosion needs. Analysis is underway that includes corn-soybean (and other) crop rotations, additional tillage scenarios, and a more rigorous analysis of erosion and soil carbon needs that includes tillage, crop rotation, slope, soil type, climate, etc. Corn stover supply estimates account for these physical and environmental conditions and also include cost of collecting corn stover (as a function of available yield/acre), transportation cost using a GIS transportation model (ORIBAS), and competition for local feedstocks as multiple plants are constructed. The corn stover supply analysis estimates maximum quantities that can be collected that either maintain or improve existing environmental parameters and is used to estimate delivered feedstock costs to multiple plants (i.e., an industry rather than a single facility) in the 100 percent available scenario. The 50 percent available scenario cuts the maximum quantity in half to account for less than 100% participation by farmers, participating farmers may not enroll all corn acres, weather may prevent collection on enrolled acres, annual yield variation, breakage and storage losses, etc.

**Results:** Two bar graphs are presented (see next page) to illustrate the interaction of user facility demand, corn stover supply, and competition among multiple plants in determining the delivered cost of corn stover to ethanol facilities. Delivered corn stover costs are lower for the 500 dMT/day across all scenarios, with the gap becoming wider as more ethanol facilities are built (even more so in the 50 percent corn stover available scenario). Furthermore, the cost of producing ethanol increases for all plants as corn stover costs increase, and after the first few plants, the cost of producing ethanol in a 2000 dMT/day plant is higher than the cost of producing ethanol in a 500 dMT/day plant. The increase in feedstock costs offset the decrease in conversion costs in the larger (2000 dMT/day) facilities as the industry expands.

### Conclusions:

- A large scale industry (i.e., one producing billions of gallons of ethanol) cannot be supported solely using large user facilities (i.e., 2000 dMT/day or greater) and a single feedstock. Only a small number of such plants can be economically viable, leaving much of the available feedstock unused.
- A future biomass industry must include a role for smaller scale facilities (i.e., 500 dMT/day or lower) and ways to reconfigure smaller facilities to be more cost effective must be addressed.
- Use of a single feedstock as the biomass resource is not likely to be cost effective, especially when combined with large scale plants. Risks are significantly increased and marginal price gaps widen substantially when less than 100% of the available feedstock is actually available. A combination of feedstock types is needed.

- While not explicitly a part of this analysis, a stated goal of the biomass program is to enhance rural development and increase farm income. Other analysis conducted by ORNL (the corn stover to ethanol macroeconomic study) indicates substantial opportunity for greater economic benefits with an industry consisting of smaller rather than larger plants. Furthermore, smaller plants are cheaper to construct presenting the opportunity for farmers to be part owner. Capturing the value added on the processing end increases farm income more than providing bulk commodities. Construction costs of large facilities significantly decrease investment opportunities for farmers.

