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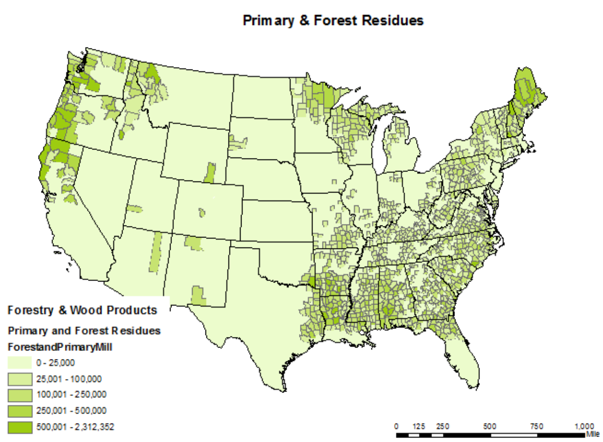
Economic Drivers of Low-Carbon Energy Solutions for Ethanol Producers

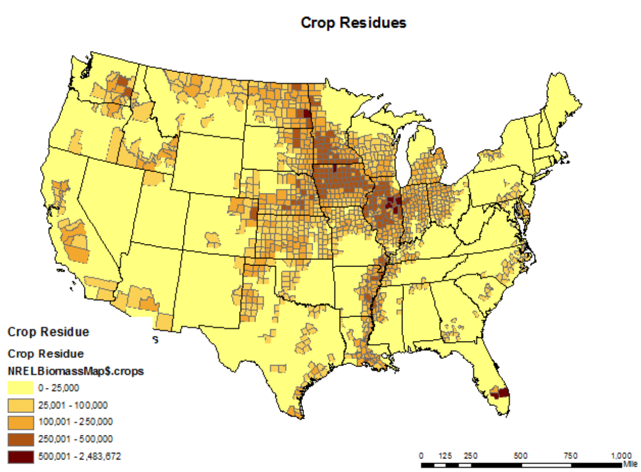
A forward-looking approach is needed to understand the current and potential macroeconomic drivers for the utilization of biomass as a feedstock for coal-fired boilers, biomass gasification and cellulosic ethanol.

By Scott McDermott

There are many intelligent researchers focused on the technology of converting biomass to energy in all of its forms. What seems to be less understood are the economics and business challenges of biomass origination, logistics, storage and handling. We are in the early stages of the evolution of the biomass-to-energy supply chain. While woody biomass residues, crop biomass residues and energy crops will be distributed across the country, their economics vary greatly.

Ascendant Partners Inc. has been working with a number of ethanol plants to better understand and implement options for lowering energy cost, for energy diversification and for lower-carbon energy. These options include anaerobic digestion of influents from inside and outside the ethanol plant, a parallel biomass delivery system for coal-fired boiler systems, biomass gasification to parallel a natural gas boiler system, cellulosic ethanol technology, as well as other minor energy improvement add-ons. What makes this analysis different today from past economic and business energy assessments is that many of the fuel sources considered today were rarely considered even three years ago. It takes a forward-looking approach to understand the current and potential macroeconomic drivers of a structurally higher energy-price environment and the growing body of greenhouse gas legislation, including the renewable fuels standard, the California low-carbon fuel standard and possible legislation regulating greenhouse gas emissions.





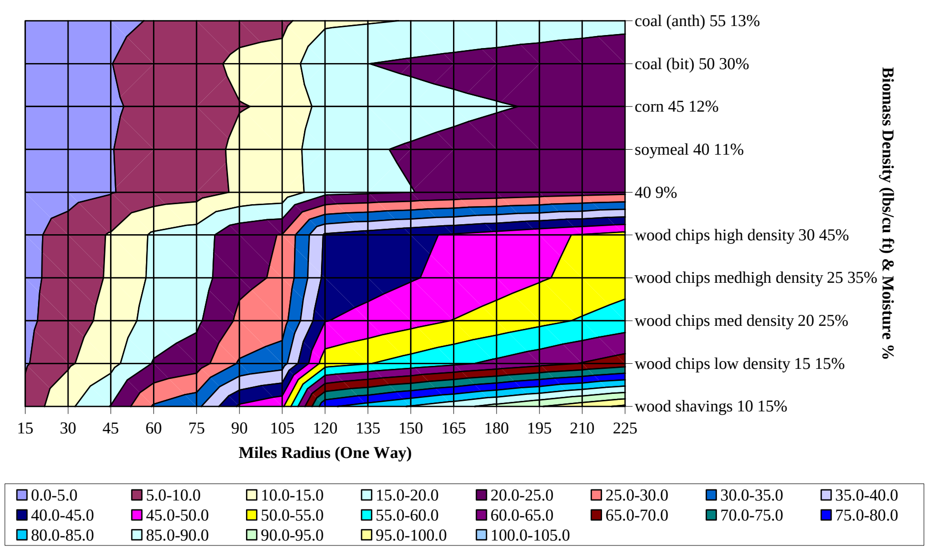
An important point to keep in mind regarding the economic drivers of biomass acquisition is that all of the potential feedstocks being considered as a fuel source are either not being utilized today, or they are being utilized in other applications because of their relatively high cost and technical challenges. Most agricultural residues are returned back to the soil because of their nutritive benefit in the crop-production cycle. Forest and wood residues are often either left in the forests or used as a base for compost, mulch and animal bedding, or are recycled or landfilled. It is yet to be seen if energy crops' agronomic and indirect land use characterization will drive their cultivation in traditional crop production areas or in new growing areas.

Pricing Strategy
If energy prices continue to rise and carbon emissions become more regulated, it is inevitable that the value of these biomass energy resources will rise as more groups attempt to utilize them. Thus a key economic driver for any group looking to use biomass feedstocks will take into consideration a long-term strategy to manage biomass acquisition costs. Many such groups observe the current market pricing structure and assume it will stay constant. They will lock counterparties into contracts that will not stand the test of time or believe they will have time to renegotiate contracts when prices start to rise. A more prudent approach would be to work directly with prospective feedstock suppliers in contract relationships for some part of the biomass feedstock requirements. The long-term goal of these contracts should be energy competitiveness relative to an energy index such as natural gas that will allow the biomass supplier to participate in higher prices while prices are depressed.

Bulk Density
The other economic drivers for biomass sourcing include bulk density and moisture content, storage, handling, logistics and energy quality. It does not matter if the discussion concerns energy crops, wood residue, agricultural residue or traditional agriculture and energy products, the fundamental economic drivers are the same. Bulk density defines how much mass can be loaded into a truck, train, barge or ship. Chart 1 shows a range of transportation costs per dry ton given different distances. The cost to move coal 120 miles can be compared to transporting other fuels the same distance—the cost for wood chips being almost three times that of coal and the cost for wood shavings being nearly five times that of coal on a dry- and moisture-adjusted basis. That is why densifying the biomass to manage acquisition costs when moving biomass long distances can be the lowest-cost biomass feedstock option.

No one wants the additional expense of densification; but if the biomass is being moved a long distance, this option may have to be considered. Typical processes increase density while driving moisture levels down. Another consideration favoring the added step is that densified biomass products can often be moved in an established handling and storage infrastructure. As stated previously, the biomass-to-energy supply chain is in its early stages, and efficient, feedstock-specific collection, storage and handling systems have yet to be developed. Being able to leverage existing infrastructure and technology can lower the capital requirements for new biomass-to-energy systems in the interim.

Biomass $ Transportation Cost / Dry Ton / Day

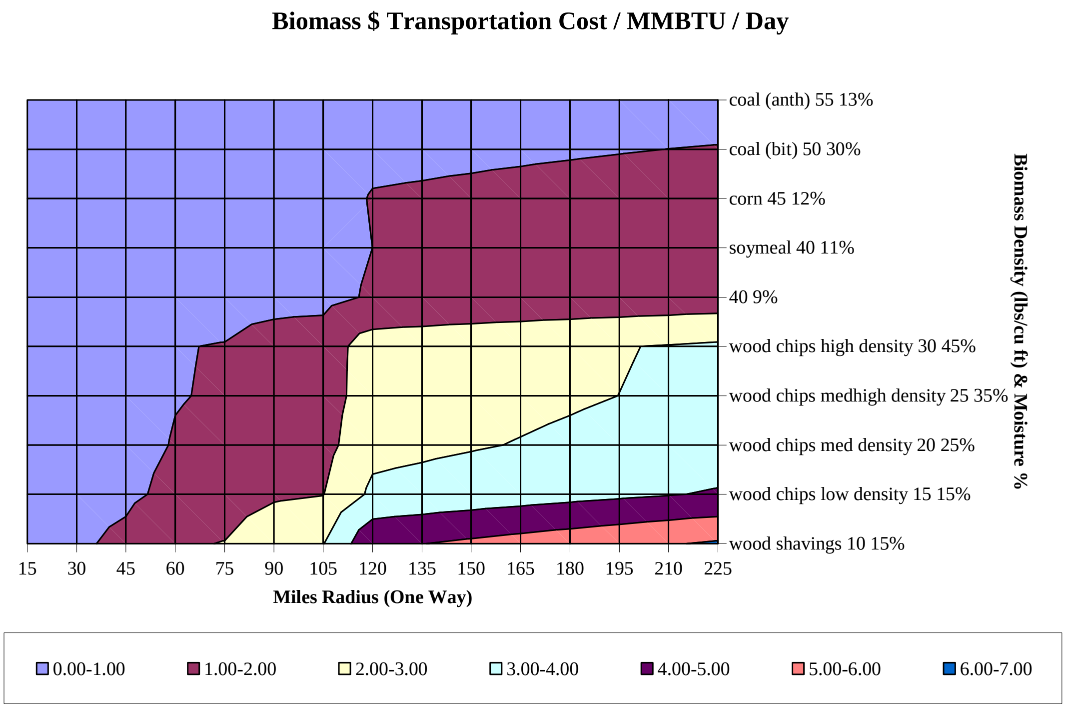


Energy Quality
The concept of energy quality may seem strange, but when it comes to biomass energy feedstocks, it is important. Unlike fuels such as coal, biomass energy feedstocks are susceptible to the elements and can degrade over time. This is a particularly important consideration for energy crops and agricultural residues because they degrade relatively quickly as they are exposed to weather, which has implications

in additional storage and handling costs, as well as the required capital to minimize degradation.

Energy Content

The final economic driver to consider is the energy content of the biomass. Powder River coal, for example, has an energy content of about 11,000 Btu per dry pound which compares to wood or agricultural residues at 7,500 to 8,500 Btu per dry pound. Chart 2 shows a range of transportation costs per million Btu (MMBtu) given different distances. If the previous analysis is extended to include energy cost per MMBtu, the cost to move wood chips 120 miles increases to 3.75 times greater than coal, and wood shavings to almost 5.75 times that of coal. If the biomass feedstock is stored where it is susceptible to the elements, it can lose as much as 25 percent of its energy content, increasing the transportation cost disadvantage to 5 and 7.5 times, respectively.



In the end, utilizing the best technology to convert biomass feedstock to energy is important, but there are other factors that also drive the competitiveness of different low-carbon energy solutions. An ethanol producer considering low-carbon biomass energy resources should understand the fuel's economic competitiveness and the business challenges of sourcing, storage, handling, transportation, infrastructure and energy quality and content, in addition to conversion and purchase price. It is important to consider the biomass economic drivers in context of a forward-looking view about how the biomass feedstocks will compete in future energy price environments, and quantifying the lower-carbon fuel benefits under current and proposed greenhouse gas and carbon regulation regimes. This combination will be beneficial in calculating the timing and best energy mix for the facility over the long term. EP

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