Carbon, Greenhouse Gas and Biomass Logistics

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Congress has charted a path such that the United States will replace nearly 25 percent of the petroleum that we currently use with biorenewable energy by 2025. According to USDA research, bioenergy will be secured from largely two sources; forest and cultivated crops. Forests cover approximately 1/3 of the US and nearly 2/3 of these forests are essentially unmanageable by today's standards. This leaves roughly 168 million acres of forest ground that is available for managed production of bioenergy. Experts believe that the management of these forests would produce 370 million tons of woody biomass that could be used to produce energy in any given year.

Cropland covers over 448 million acres; of which 67 million are in pasture and 39 million have been laid idle via CRP programs. This number of acres could sustain production of nearly 933 million tons of biomass each year. According to USDA sponsored research, 425 million tons of biomass would be derived from crop residues, 377 million tons from perennial crops, 56 million tons from grain, and 75 million tons from manure. Researchers have documented that as crop yields (bushels per acre) have increased, the volume of biomass that is available for energy production has also increased. In addition, the adoption of no-till farming (now at over 60 million acres) has also increased the volume of biomass available for energy production.

During the last 50 years, the electrical power industry centralized much of their production capabilities. Cheap petroleum perpetuated affordable freight rates and ultimately brought about the demise of much of the rail industry, an industry that still has the potential to reduce greenhouse gases.

According to USDA research, the cost to truck forest products to a centralized facility for energy use ranges from 20 cents to 60 cents per dry ton mile. Therefore, trucking woody biomass 150 miles would result in an average trucking cost of $60/ton. After adding the cost paid to the farmer ($40.00/ton), the real cost of the woody biomass is $100/ton. Since the BTU value of wood is approximately 7,700 BTU per pound, this means you are paying $100 for 15,400,000 BTU (2000 lbs * 7,700 BTU/lbs = 15,400,000 BTU).

In comparison, the current diesel fuel costs are $2.66/gallon. The BTU value of one gallon of No. 2 diesel fuel is 138,000 BTU. If we divide 15,400,000 BTU/ton by 138,000 BTU/gallon we determine that the energy in one ton of biomass equals the energy equivalent of 111.6 gallon of diesel fuel. The equivalent dollar value of diesel fuel, delivered to the door for use, is $296.86 ($2.66 / gallon * 111.6 gallons).

These numbers suggest that the use of wood products can be a cost effective solution for an electric power plant. Our automobiles are not designed to be fueled with wood energy but many of the power plants that are fueled with coal can use woody biomass directly. The literature suggests that this does not come without any additional costs. According to Gregg Coffin, University of Missouri Power Plant Superintendent, many of the biomass fuels contain higher levels of chlorine and that the "high chlorine content results in acid corrosion at the back of the furnace as it reaches its dew point. This occurs in different locations depending on boiler design and configuration. Also chlorine emissions, via HCL emissions will be regulated soon through a revised boiler MACT regulation. "

Coffin noted that by "limiting the total content through fuel blending, injecting an acid neutralizing agent like hydrated lime, and dry scrubbing which utilizes hydrated lime as a capture agent" so they can offset the impact of chlorine. "Some boiler technologies are better suited to utilize high chlorine fuels, for example circulating fluidized bed (CFB) boilers self scrub in the combustion process and generally can handle fuels with slightly higher chlorine content." Coffin also noted that "fuels from grass and other agriculture residues are harder to combust than woody biomass."

I feel that one of the keys to immediate and successful implementation of using biomass for energy is to evaluate systems that reduce transportation costs. The centralized system we currently use to provide energy for the consumer may need to be re-visited but it may be too costly. The satellite system used by the sugar beet industry, where the sugar beets are moved short distances and stored for a short period of time should be considered. At this satellite delivery point, value is added to the product. The dirt from the sugar beets is removed and returned back to field prior to transporting the sugar beets to the refinery.

Showme Energy located in Centerview, MO has successfully implemented a similar system. Several hundred producers transport biomass to Showme where the biomass is then mixed to produce a uniform product prior to densification into pellets. The biomass pellets are then transported at a much lower cost to a power plant for combustion, and the power plant receives a uniform fuel to fire their boilers. As noted earlier, additional management will be needed at the power plant to compensate for issues like higher chlorine levels found in biomass.

The benefits of fueling with biomass, from the standpoint of greenhouse gases, appear to be worth the investment. The use of oil from either rapeseed (44-63 percent) or soybean (41 percent) to produce biodiesel rather than fueling with diesel fuel reduces greenhouse gases. The use of corn grain alcohol (17-50 percent) rather than petroleum also reduces greenhouse gases. Palm oil biodiesel and sugarcane ethanol reduce greenhouse gases by nearly 100 percent. In short, fueling with biofuels rather than with petroleum can serve to reduce global warming.

We are moving into a much more complex energy system to fuel our country. No one single fuel will be as universally used as we currently use petroleum. Biomass that are indigenous to certain regions of the US will largely be used within that region, and the most effective means to accomplish this may very well be the decentralization of our current energy systems. This could simplify some local logistic issues and reduce the cost to deliver biomass energy to the end user. The adoption of biomass fueling systems, at the same time, could serve to reduce and/or slow the global warming trends noted by our leading scientists.