The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Biofuel progress, a report from Dubuque

Posted by Heading Out on October 17, 2007 - 7:30pm
Topic: Alternative energy
Tags: algae, cellulosic ethanol, combustion, corn, ethanol, iowa, pyrolysis, switchgrass, wisconsin, wood harvesting [list all tags]

The fun thing about conferences is that there are also sorts of individual lines that presenters say that could be pulled to the headline, and perhaps be more mischievous than helpful. I was thinking that today, when the opening speaker began with explaining why she couldn't start her talk with a joke. Turns out that when she tried to Google "ethanol and Joke" all she got was pages of citations of "ethanol is a joke" or "ethanol is a big joke!" Conference, you say, speaker, you say, but I thought the ASPO Conference didn't start until tomorrow?

Well yes, that's true, but sometimes if you want to catch some of the developing stuff, or the stories that never make it to the National Meetings, you can learn a lot from smaller conferences, and so I came to Dubuque. Today is the first of two days on "The Impacts of Increased Bio-Fuel Production on the Midwest Landscape." At a time when the current ethanol situation has been described as "the farmer's version of the gold rush," it was interesting to hear what is happening down at the farm level and in planning within the Midwest to look at answers to the looming problem. Some of the papers today discussed switchgrass, and algae, and biodiesel and how to effectively harvest the "crappiest wood" in the U.S. and turn it into useful energy. And in the discussions, in a town where the corn grows right up to the airport runways, there was a lot of realism in the discussions of water needs, and soil nutrition replacement and bottom line cost levels.

Since, alas, courtesy of American Airlines this was the second time I missed my connection in Chicago, and had to overnight there, before getting up before dawn to get here, and since I have to get up even earlier tomorrow to catch the flight to Houston, this post won't quite be as detailed as I would like. Nor will I give my book review on my traveling book (Sandalow's "Freedom from Oil") until after Houston. And I apologize to the presenters who gave detailed presentations, (not otherwise available) at this meeting of the Soil and Water Conservation Society that I will not be able to give those talks full justice. But let me try and give you the gist of what I learned.

The meeting started with a presentation by Diana Friedman of SARE, Sustainable Agriculture Research and Education, whose talk was "Beyond Biofuels." The group is about to publish a pamphlet on "Clean Energy Farming," and it was information on this that she talked about. One of their issues, and one that was common to a lot of today's discussion was on the need to re-invigorate the rural communities and the benefits that sustainable agricultural solutions would have to that economy and those goals. Skipping a discussion of ethanol, (too polarizing) she talked about the benefit of Energy Audits, and how they could help farmers, though even when done they were not always followed through, noting that Energy Efficiency provides the best and

fastest payback. She noted that 3-5% of the Iowan energy cost could be reduced just be better vehicle maintenance and upkeep of farm equipment.

She gave examples of innovators in the industry Piemont Biofuels who have established a biodiesel operation that reached its first year target within 6 months of start-up, and who are using solar heat to help in running the plant. John Williamson (pdf file) who also includes passive diesel in a farm-scale closed loop energy operation, in which he uses sorghum to provide the ethanol for plant equipment; Mike Collins (pdf) who operates greenhouses and converted them to using waste oil in the furnaces; Don Bustos who, facing bills that would drive him from the land his family had owned for 400-years, used undersoil piping with geothermal cooling in summer, and solar heat in winter to eliminate fuel costs from his greenhouse operation; Dan West who uses fruit waste to generate ethanol and who glued mirrors to an old satellite dish to make a pre-heater for the ethanol; Plug Flow Digesters (pdf) who use the "output" from 560 milk cows to generate 60 kW of power; and Community Wind Power of Wisconsin, where 12 farmers raised $3.6 million to buy and install 2 1.9 MW wind projects, setting up a 15-year contract with the utility.

She discussed recent government initiatives, including the Sun Grants, and the trends in future legislation, with the goal of 36 billion barrels of renewable fuel by 2022, of which only 15 billion would be from corn ethanol. She mentioned the initiative to provide funds for farmers to start producing the feedstocks for the nascent cellulosic ethanol industry (though she noted that it "wasn't here yet") and that the Sustainable Biodiesel Alliance were beginning to formulate and codify how that industry might operate. In general she felt that the opportunities outweighed the challenges. In regard to corn ethanol, while we are still living the "gold rush times" there may be a course correction coming in regard to capital investment.

In comments someone said "ethanol is a 50-year blip on our energy plot, and we're 25 years into it." And someone else noted that we will transition from ethanol to pyrolesis of much of the feedstock because of water issues.

Brian Wrenn of the National Corn-to-Ethanol Research Center gave a talk that introduced the Center, budget $4 million, half from industry. It is involved, among other things, in training ethanol plant operators, for which there is currently much demand. Almost all new ethanol plants use dry grinding and he had a good map (from the NCGA) showing where the ethanol plants are, and are planned. It is heavily oriented to the MidWest. (not surprisingly). Half of their research is dealing with what to do with the Brewers grain that is a byproduct of the ethanol generation. They are looking at pre-fractionating the corn to remove the non-starch components pre-digestion and maybe using that in a cellulosic treatment. We are at 12 billion bu this year, with a lot of the increse starting to come from increased yields, rather than acreage. We will have 8 billion gall of ethanol (4% of gas used) reaching 15 billion gal by 2015 (7% of gasoline). This is currently using 20% of the corn crop and will rise to 33%. The big issue however is water use. It takes approximately 5 gall of water per gallon of ethanol, so that a 50 million gal/yr plant will use 600,000 gal of water a day, which is more than the ratio of water used in refining gasoline (3 – 4.5 gal/gal). Much of the water loss is in dissipating the heat of the process.

There is still no good way to harvest, store, and transport feedstocks for cellulosic (see Dora Guffey's talk later), and the chemicals used for pretreatment inhibit fermentation. And while enzyme activity in cellulosic has been improved, it is still very slow. And the water use/gallon of product is double. Further the pre-treatment water cannot be re-used, but must be discharged, preferably to a municipal sewer, since it contains organics that sewer treatment plants can deal with.

His ultimate conclusion was that the costs of making ethanol are what they are, and as a result the best path forward is conservation. (Since if we reduce the overall amount then we can meet the mandated percentage). Using corn stover is like a lot of biofuel ideas, it sounds good – until you start thinking about it. In the debate about that the numbers for stover, I got the impression that there are about 5 t/acre generated, and that it is acceptable to remove about 1.5 tons, since this also helps with no-till operations, without depleting the nutrients too much.

After the break there were four talks on Alternate Biofuels, starting with one by Hank Stetzler of the University of Missouri, who talked about sustainable forest thinning. With Missouri having the "crappiest wood" in the country, and lots of unproductive underbrush and poor timber, there is a potential to thin the forest to provide a better environent. By using satellites and "real truth" techniques, and then assessing the relative volumes of wood available, and accessible (no >30 deg slopes) and near a highway (while not precluded by other use) they were able to identify a resource of perhaps 9 green tons per acre. If the tops are left (and perhaps laid to protect the access paths from erosion) this leaves most of the nutrient in the forest, while improving the forest, and providing a resource.

The problem is how to convert this into an economic energy supply. Harvesting techniques have been studied, as has close-to-growth portable charcoal kilns that also produce the liquid byproducts, and which combine to make transportation costs more effective. (Hauling chipped wood is expensive). Trees under 8-inches yield nearly 100% biomass, by 11-12 inches this drops to 40%; 12 – 16 inches yields 25% biomass, and above that less than 20%. By looking at where the best resource lies, and the practicality of the use, they identified 3 locations in Missouri, Frederickton, Cuba and Thayer, where a potential use site could be created. Much of this land is in private hands, but if only 5% became involved it would be enough to provide a sustainable supply.

One potential is to generate pellets (this is done at NW Missouri State who burn a mix of 80% wood chips, 15% pelletized paper/trash from the campus and 5% pelletized animal waste). The increasing costs for transportation have reduced the viable collection area around a plant from 70 miles to 25.

The second paper was supposed to be be on the use of Osage Orange, which can produce 500 gallons of diesel, 750 to 900 gallons of ethanol and 4-5 tons of combustible biomass per acre per year, but unfortunately Alan Gravett the author could not make it. The operation recently obtained a $325k award from the DoA .

Brett Hulsey of Better Environmental Solutions talked of the use of various biofules. He noted that in the report "Cleaning the Air with Ethanol", authored during the Carter Administration, cellulosic ethanol was said to be 5-years from viability. It is now said to be 2. He noted that it is currently uneconomic, given the price of soybean oil, to make biodiesel. The same concern might exist for corn ethanol, save only for the tax breaks that it currently gets, and which provide a profit of $0.50 to $1.00 a gallon (not bad for 20 million gal/year plant owners). Wisconsin spends $18.5 billion on fuel, 60% of which money leaves the state, but if $12 billion is spent on renewable energy then it will create 300,000 jobs. It will currently in displacing diesel and benzene, reduce the cancer causing components of current fuel mixes. He noted that using rice straw had an energy return of 9:1 (not sure what he was talking about here) and that Wisconsin could utilize 4.9 million tons of crop residue a year; 3.4 million tons of CRP grass; 2.9 million tons of hybrid poplars; 2.2 million tons of forest residue; 1.7 million tons of mill waste; 0.55 tons of urban waste; 0.32 million tons (sic) of methane; and 0.051 million tons of manure, which gives 14.8 million tons that could be combusted to provide fuel. Burning matter is not new and by now we know how to

do it. We have the rivers that help with transportation, and if grass is burned it can provide ten times the energy source of solar and wind. And again he mentioned recovering 1.5 tons/acre of corn stover to help with no-till, while providing an energy source.

He noted that the manure from dairy herds (and Wisconsin has a large dairy herd) is a possible source for cellulosic ethanol since it is already partially digested and has a much better payback this way then by using it as a fertilizer. The problems with developing the new renewable fuels is that no-one will invest in the production of feedstock, until they see a need, and no-one will invest in the plants until they see the production. One problem he did mention was that it appears that burning corn stover in power plants raises corrosion issues. (Such is not the case with burning wood with coal, since this allows combustion of high-sulfur coals without the sulfur dioxide emissions).

This combustion issue was part of the presentation by Dora Guffey of the Chariton Valley Biomass Project who discussed a program in which switchgrass has been raised on delicate land, and harvested and burned in controlled tests at a normally coal-powered plant. The intent was to see if using this grass, which controls erosion, and improves soil quality could provide a viable fuel alternative. Three test burns have been made, addressing such issues as boiler corrosion.

They harvest the grass after a killing frost, so that virtually all the nutrients have left the plant body which is harvested, and are left in the root bit which is left on site. The grass is bundled into special bales 3 x 4 x 8 ft, and hauled to storage. You can't leave it in the field as it wicks water, and it must be stored on gravel in a barn (same reason). Bale integrity controls energy availability. The bales weigh 1,000 lb and when reground for combustion they prove to be abrasive, and moisture content helps with this (12% moisture at the boiler if kept well, which matches the harvested value). The third test burn used 25,000 tons of grass over the 90-day test period. It cost $61 per ton for haulage, and $26 per ton for re-processing the grass at the power plant into small fragments (< ¾ inch) that could be blown into the furnace. The plant was paying about $20 a ton for the coal, and in the above you will note that the farmer did not get paid for the grass. Like the coal, the grass had to be totally consumed by the fireball within 3 seconds of being fed into the boiler fireball.

They displaced 2% of the coal in these tests, and are now permitted to burn the switchgrass. It should be noted, however, that fields of switchgrass can contain up to five different plants and all must be permitted (only one is, and it was selected for by using herbicides on the test plots). Thus more extensive testing will be required before a more general feedstock can be used. There is a concern that with the grass growing near waterways, any use of controlling chemicals might enter the waters, which would be a strong negative. Increasing transportation costs will negatively impact this project.

The final paper was by Dave Summers, of the University of Missouri-Rolla, talking about the growth of algae underground. I noted that some of the slides he used to illustrate the critical need for new fuel sources bore a remarkable resemblance to some of the information from this site. He quoted the Greg Paul number of 2,500 gallons of biodiesel, per acre, per year, from algae in comparison with the yields of other biofuel sources. He talked about experiments that are ongoing to identify high-yield varieties, finding that the local pond, for example contained algae that had nearly 25% oil content. The program, which is ongoing, is currently looking at the energy balance in supplying energy to the algae, and using LEDs in controlled frequencies to examine their potential in supplying the light more efficiently. (Sorry I did not take good notes).

Well 4 am is going to come very soon, and if I am to make that flight . . . . .