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Cellulosic Ethanol Reality Begins to Set In

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Delusional Mandates

It is hard to believe that just a few short years ago, Congress mandated a massive increase in usage of cellulosic ethanol. This was remarkable, because no commercial cellulosic ethanol facilities even existed at the time. But people like Vinod Khosla were busy testifying before Congress that the only thing holding the industry back was more funding, and if they would provide the funding we could replace all of our gasoline consumption with cellulosic ethanol.

So Congress mandated in the 2007 Energy Independence and Security Act that we would use 100 million gallons of cellulosic ethanol in 2010, 250 million gallons in 2011, and then rapidly expand to 16 billion gallons per year by 2022. At the time, I saw a very appropriate analogy that summed up the situation: "It's like trying to solve a traffic problem by mandating hovercraft. Except we don't have hovercraft."

I tried to bring a dose of reality to the debate in this blog. I have worked on cellulosic ethanol myself. I know first hand the challenges. Biomass has low energy density relative to fossil fuels, and thus a conversion facility must have easy logistical access. In most cases, this means that biomass must be sourced close to the facility. This puts some limits on the size of biomass facilities, so they suffer from the lack of economies of scale. I have harped on this logistical issue for years, and a newly released study from Purdue reiterates the points I have made: *"Without solving the logistical issues, commercial production of second-generation biofuels will not take place."*

Further, cellulose generally makes up less than 50% of the composition of biomass, limiting the biomass fraction that can be converted into ethanol. The fraction that is converted ends up as a dilute beer of generally around 4% ethanol and 96% water. This makes the energy requirements of purifying cellulosic ethanol very high. Of course if you listen to Bob Dinneen and the guys at the Renewable Fuels Association (RFA), they say the issue is that not enough money is being thrown at the problem. But that's their answer to anything ethanol-related: We need more money.

Commercialization attempts for cellulosic ethanol date back over 100 years. Germany was the first to commercialize cellulosic ethanol in 1898. Commercialization came to the U.S. in 1910, when Standard Alcohol Company built a cellulosic ethanol plant in Georgetown, South Carolina to process waste wood from a lumber mill. Standard Alcohol later built a second plant in Fullteron, Louisiana. Each plant was designed for 5,000 gallons of ethanol per day from wood waste, and both were in production for several years. Both plants were eventually closed due to lack of economic viability.

Snap Back to Reality

In early 2010, 100 years after the first cellulosic ethanol plant was built in the U.S., the EPA recognized that the cellulosic ethanol mandates could not be met. They subsequently reduced the

100 million gallon mandate for 2010 to 6.5 million gallons. (Actual qualifying production of cellulosic ethanol through October 2010 is zero gallons). MIT Technology Review posed the question What's Holding Biofuels Back? I responded with the answer in What's Really Holding Cellulosic Biofuels Back. I have maintained that future mandates would also have to be cut, and the EIA recently indicated that they agree, at least for 2011:

EIA cuts cellulosic producers from 2011 list

> The U.S. DOE's Energy Information Administration has completed its predictions for next year's cellulosic biofuels production and estimates that **actual production levels will be much lower than anticipated**. Earlier this year, the U.S. EPA proposed a reduction in the cellulosic biofuels portion of the 2011 renewable fuel standard (RFS) to between 5 and 17.1 million gallons, down drastically from the 250 million gallons initially called for in the 2007 RFS. But according to an Oct. 20 letter sent from EIA Administrator Richard Newell to EPA Administrator Lisa Jackson, the EPA's reduced target is still too high. The EIA suggests that a more likely 2011 production total for cellulosic biofuels is approximately 3.94 million gallons. Additionally, the EIA said half of the facilities on the EPA's list won't produce biofuels next year.

So the EIA projects that 2011 cellulosic ethanol production will be 3.94 million gallons, less than 2% of the originally mandated amount. They suggest that the EPA, having cut the 2011 estimate from 250 million to the range of 5 to 17.1 million gallons, is still much too optimistic, and that half of the facilities that the EPA expects to produce cellulosic fuel will not. Following the EIA story, the EPA has come back and revised their 2011 numbers down to 6.6 million gallons of cellulosic ethanol.

Better Late Than Never

Back to the EIA report, they were quite frank in their assessment of Range Fuels. If you recall, I was the first to point fingers at the vast disconnect between Range Fuels' early, hyped up promises and the constantly diminishing expectations of what they would actually deliver:

Broken Promises from Range Fuels

I contrasted the more than $320 million that they have taken in and the promises of a 100 million gallon cellulosic ethanol plant (which they had said would cost $150 million) with this year's admission that they would only have 4 million gallons of methanol capacity. But you wait, they insisted. They were going to get that plant up on methanol, and then switch over to ethanol and all would be right in the world. But they just needed more money.

Oh, I had my critics. Defenders of Range — including Range themselves — began to come out and insist that I didn't know what I was talking about. Well, the EIA had something to say about that:

> **Range Fuels** Inc., which was excluded from the EPA's proposal, **is expected by the EIA to provide 1 million gallons of methanol next year**. The plant's Soperton, Ga., capacity is 4 million gallons, however, "**we assumed a 25 percent utilization rate due to its repeated inability to meet stated production goals**," Newell wrote.

Repeated inability to meet production goals. Range Fuels is starting to look like the Pets.com of the cellulosic ethanol world. They won't be alone, but they are the highest profile example of cellulosic hype colliding with cellulosic reality.

Conclusion – Technological Breakthroughs Can Not Be Mandated

Personally, I don't believe large-scale commercialization of cellulosic ethanol will ever be viable due to the aforementioned fundamental issues with biomass conversion and efficiency, and will ultimately be relegated to the role of a niche fuel provider (as discussed in Biofuel Niches). The heart of the problem here was the idea that technology can be mandated. Imagine that in 2005 Congress put forward a mandate that lung cancer would be cured by 2010, breast cancer by 2012, and by 2020 all cancers would be cured. People would think they were absolutely daft, because more people understand the difficulties involved in coping with cancer. On the other hand the general public doesn't have a clue of the difficulties in economically turning cellulose into fuel, but they did hear a lot of hypesters in the news saying that it would be easy — as long as you get that Silicon Valley "know how" working on the problem. But the Silicon Valley players learned that Moore's Law doesn't apply to the energy business.

It is great to have lofty goals, but when you start to base your energy policy on fairy dust, you are setting yourself up for massive problems down the road. Technology breakthroughs can't simply be mandated. Sometimes critical breakthroughs happen, and sometimes they don't. In the case of cellulosic ethanol, commercial viability remains out of sight.