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Cellulosic biofuels market uncertainties and government policy

“...the existing government policies do not provide the degree of reduction in uncertainty that would be needed to induce commercial investment in cellulosic biofuels.”

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Potential investors in cellulosic biofuels face a number of different uncertainties that collectively deter investment in the sector. I characterize the uncertainties in three major groups: market, technology and government policy. In the current environment of recession and financial market mayhem, one could add finance as a fourth category of uncertainty. In this update, I will treat each of these in turn and ultimately focus on government policy as both a potential hindrance and stimulant to investment, depending on how the policy is designed and implemented.

Market uncertainty is huge. Most of the cellulose biofuel technologies being developed today require crude oil prices of US\$120/barrel or higher without government support. The US Department of Energy (DOE) 2010 Annual Energy Outlook has three crude oil future price scenarios, with the 2030 reference-price case being approximately US\$120 and the low- and high-price cases being US\$50 and US\$200 for 2030 [1]. This outlook demonstrates that future oil prices are highly uncertain. If your technology has a breakeven today of approximately US\$120 and the DOE 2030 oil price barely surpasses that level, there is no way you would make the investment today without substantial government incentives. In today's financial environment, there will be no venture capital forthcoming without much greater certainty created on the market side through government intervention.

The second great source of uncertainty is technological. Since there is no commercial production of biofuels from cellulose, we simply cannot be sure what it will cost to transform cellulosic feedstocks into liquid fuels.

There are two major categories of transformation processes: biochemical and thermochemical. Biochemical processes must accomplish the task of separating out the lignin and gaining access to the cellulose and hemicelluloses to efficiently convert them to ethanol or other biofuels. To date, the enzymes required for this conversion are expensive and the total costs of conversion are quite high. Furthermore, most of the processes produce ethanol, which is subject to a 'blend wall' in the USA [2]. Thermochemical processes convert the whole biomass into either a bio-oil using a pyrolysis process or into a syngas using a Fischer–Tropsch process. The syn-gas or bio-oil can then be converted to a range of hydrocarbon products. Since biogasoline, biodiesel and biojet fuel, for example, are produced directly by these processes, there is no constraint imposed by the ethanol blend wall. However, these processes generally have very high capital costs. Recently, variants of the fast pyrolysis process have demonstrated promise, but the technology and its associated costs still remain highly uncertain.

The third area of uncertainty is feedstock costs. For years, the DOE maintained a target of US\$30/dry ton delivered as its feedstock cost target. However, today it is widely recognized that feedstock costs will be substantially higher than this level. A recent National Academy of Science study produced baseline feedstock costs ranging between US\$70 and US\$151/dry ton depending on the source of the feedstock [3]. While most of the literature yields cost estimates considerably below this range (generally US\$45–90), feedstock cost today is believed to be considerably higher than early estimates, except for some

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small niche supply sources. Since feedstock costs constitute a large fraction of the cost of the final product, uncertainty in feedstock cost translates directly into uncertainty in the bottom line of any prospective processing plant.

Another feedstock issue is assurance of supply. Many of the feedstocks being considered are perennial crops, such as switchgrass, miscanthus or woody crops. To entice farmers to plant these crops will require development of long-term (10 years or more) contracts for feedstock supply. How will the feedstock be priced in these long-term contracts? Will the price be indexed to some indicator of production costs, energy prices or some combination of these? It is unlikely that investors will sink the US\$400 million in plant construction cost until they have an assured source of supply of raw material.

The final source of uncertainty is government policy. In the USA, the federal government has different kinds of incentives to encourage cellulosic biofuel production. Among these are the following:

- A renewable fuel standard (RFS) that requires that 16 billion gallons of cellulosic-based biofuels be produced by 2022 [4]. According to the RFS, 100 million gallons of cellulosic biofuels should be produced in 2010. However, given that the production capacity does not exist, except for some small demonstration plants, the Environmental Protection Agency (EPA) has reduced the cellulosic RFS for 2010 to 6.5 million gallons [5];
- A federal subsidy of US\$1.01/gallon of cellulose biofuels. However, the subsidy is set to expire in 2012 and what action Congress might take on an extension is unknown;
- A federal subsidy for cellulosic feedstocks of up to US\$45/dry ton for up to 2 years has been established. However, it is currently oversubscribed, and it would not provide a long-term reduction in plant feedstock costs;
- The federal government also has programs for guaranteed loans for cellulosic conversion facilities. To date, these have been used for pilot and demonstration facilities.

None of these policy interventions individually or collectively provide the reduction in uncertainty that would be needed to induce investment in cellulosic facilities. The RFS has multiple off-ramps, such as the one used in 2010 by the EPA. In essence, if the production capacity does not exist, the EPA cancels the mandate, which means that investment is required before the mandate becomes binding. EPA also has the right to waive the

RFS if it would impose significant economic hardship [6]. In other words, the RFS is not an iron-clad mandate, which is what would be required to assure investors that there will be a guaranteed market for their product.

Throughout its history of intervention in biofuels through subsidies, Congress has always placed a term limit on the subsidy. Usually the limit has been 5–8 years out. That time limit means that potential investors can be assured of having the subsidy only for a short period of time during the production life of the plant, since these plants will require 2–3 years for construction.

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Options that do a better job of guaranteeing a market would be much more likely to be successful in launching the industry. An example would be a reverse auction, in which the government issues a call for a fixed quantity of biofuel with a given specification and delivery point. For example, it could say that we want 200 million l/year for the next 15 years of bio-JP8 (jet fuel) delivered to air base X. Companies would bid for the right to supply under that contract. Such a system would eliminate market price uncertainty and government policy uncertainty and leave mainly the technical uncertainty. Another option would be a variable subsidy that makes the level of government support dependent on the market price of crude oil. Above some threshold level of crude oil price, the subsidy would go to zero and it would increase for every dollar crude oil fell below that threshold price. In a sense, the variable subsidy is similar economically to the reverse auction in that it reduces substantially market price uncertainty.

The bottom line is that the existing government policies do not provide the degree of reduction in uncertainty that would be needed to induce commercial investment in cellulosic biofuels. In today's financial markets, it is even more difficult for venture capitalists to consider investments in this sector. Therefore, without changes in our current approach, biofuels targets are unlikely to be achieved.

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The author has no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

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Bibliography

- 1 US Department of Energy. Annual energy outlook 2010 – early release overview. 12, DOE, USA (2009).
- 2 Tyner W, Viteri D. Implications of blending limits on the US ethanol and biofuels markets. *Biofuels* 1(2), 251–253 (2010).
- 3 National Research Council of the National Academy of Science. Liquid transportation fuels from coal and biomass: technological status, costs and environmental impacts. Washington, DC, USA (2009).
- 4 US Environmental Protection Agency. Renewable fuel standard program (rfs2) regulatory impact analysis. 1120, EPA, USA (2010).
- 5 US Environmental Protection Agency. Part 80 – regulation of fuels and fuel additives. 120, EPA, USA (2010).
- 6 US Congress. Energy independence and security act of 2007. *H.R. 6, 110 Congress, 1st Session* (2007).