Putting the Pieces Together: Commercializing Ethanol from Cellulose

A Response to the U.S. Department of Energy

by

David Morris, Vice President
Institute for Local Self-Reliance

Summary

On June 14, 2006 the U.S. Department of Energy issued a Request for Information (RFI) "regarding the most beneficial and efficiency way to consider implementation of Section 942" of the Energy Policy Act.

We are concerned that by focusing on a single policy tool--a large government purchase--the RFI undermines holistic thinking. The Energy Policy Act contains provisions that allow a number of cellulosic ethanol commercialization tools to be used (direct grants, loan guarantees, direct incentives, large federal purchase). DOE should invite the public to comment on how best to combine all of these tools into an effective program.

The most significant part of the Energy Policy Act is its mandate for 250 million gallons of annual cellulosic ethanol production by 2013.

Using the Act's incentives will not significantly reduce the time in which its quantitative goals are met. Therefore DOE should use the incentives primarily to meet the Act's qualitative objectives. These include maximizing the benefit of cellulosic ethanol production to farmers and rural areas, stimulating a diverse array of feedstocks, processing technologies and geographic locations. If properly designed, these incentives can play a very important and perhaps even determining role in achieving these objectives.

- DOE should use the Act's seed grants to nurture many geographically dispersed farmer or locally owned pilot plants (500,000 gallons per year capacity) that rely on a variety of feedstocks and technologies.

The Act mandates the sale of 250 million gallons of cellulosic ethanol by 2013.

- DOE should use the Act's direct incentives and/or reverse auction tools to nurture many small commercial scale plants (5-10 million gallon capacity). Here too priority should be given to majority farmer- or locally-owned plants and feedstock, technological and geographic diversity.
- DOE should use the Act's loan guarantees to facilitate larger plants (25-35 million gallons per year), again encouraging farmer or locally owned facilities.

Discussion

The Energy Policy Act establishes both quantitative and qualitative goals for biofuels.

The quantitative goals include: 1) a mandate for 250 million gallons of cellulosic ethanol production by 2013, and; 2) a goal of a billion gallons of cellulosic ethanol production by 2015.

The qualitative goals focus on maximizing the economic benefits to farmers and rural areas.

The Act authorizes over $2 billion to finance four discrete yet overlapping commercialization strategies: direct grants (Sections 932, 1511, 1512); loan guarantees (Section 1510); direct purchasing via a reverse auction (Section 942); direct per gallon incentives (Section 942).

As of September 2006, Congress has not appropriated funding for any of these strategies. Appropriations will almost certainly be less than the spending authorized.

Congress has yet to fund any incentive... Funding will be addressed in Fall 2006.

In the next few months Congress will address the funding question. The discussion will almost certainly prompt a conversation about the comparative benefits of each incentive.

By singling out just one strategy-the reverse auction, a large government purchase where the level of incentive is determined through competitive bidding-for public comment, as it did in its June Request for Information, DOE is missing an historical opportunity to invite an increasingly interested nation to participate in that discussion and to address the cellulosic ethanol challenge.

It should be noted here that even without appropriations, DOE has already begun to implement various pieces of the Act.

In February 2006, DOE issued a Request for Proposals for direct grants of up to $80 million for the construction of integrated biorefineries under Section 932. (DOE advised potential applicants that the availability of grants depends on Congressional appropriations.)

To our knowledge, DOE has neither issued a request for information nor a request for proposals for two other sections of the Act that offer direct grants (Sec. 1511, 1512). Nor has it issued a request for information or a request for proposals for the loan guarantees contained in Section 1510.

DOE should not implement the Energy Policy Act in piecemeal fashion. The sections of the Act can and should work together.

The Changing World of Ethanol

In implementing the Act, DOE should take into account the dramatic changes that have occurred in the world of ethanol in the 12 months since the passage of the Energy Policy Act in August 2005.

In the last year, over $4 billion has been invested in new facilities. U.S. production capacity could well exceed 8 billion gallons by 2008, surpassing the 2012 Congressional mandate of 7.5 billion gallons. The anticipated increase in the price of corn from this increased demand, as well as the 250 million gallon cellulosic ethanol mandate for 2013, has spurred significant venture capital investments in making ethanol from cellulose.

By the beginning of 2007, half a dozen companies around the world may operate cellulosic ethanol pilot plants producing 50,000 to 750,000 gallons a year.

To satisfy the 250 million gallon production mandate in 2013, significant quantities of cellulosic ethanol must be produced in 2012. The construction of some plants could begin as early as 2011.

It is doubtful that the Energy Act's other incentives will accelerate the mandate's timetable significantly.

The Act requires a reverse auction to take place "no later than August 2008." Suppliers must provide ethanol within three years (i.e. by August 2011). The earliest loan guarantees could be issued would be mid to late 2007. The loan guarantee program also requires production within three years (e.g. by 2010).

Congress might appropriate funds more quickly. The loan guarantee and reverse auction programs might begin more quickly. New facilities might become fully operational before their three-year deadlines. Nevertheless, given the 2013 mandate and the extended timetable for production from the use of the incentives, it appears that, at best, incentives may accelerate significant production of cellulosic ethanol by only 12 to 18 months.

DOE should also take into account the interaction of market prices and government incentives with regard to cellulosic ethanol.

ILSR estimates the cost of cellulosic ethanol from the first generation of commercial plants will be in the $1.90-$2.25 per gallon range, excluding incentives. This compares to the current cost of $1.20-$1.50 per gallon for ethanol from corn.

If crude oil prices remain above $70 per barrel, cellulosic ethanol will be competitive, or nearly competitive, with oil but not with grain (or sugar cane) ethanol. In this case, to accelerate the 2013 mandate, DOE will have to offer cellulosic ethanol a substantial additional incentive over that currently given to corn ethanol (or the incentive for corn ethanol could be reduced). If corn prices rise significantly because of increased demand, cellulosic ethanol will need less and perhaps no incentives to competitive with corn-derived ethanol.

The Department of Energy seems to recognize that incentives may not prove cost-effective in accelerating the 2013 mandated goal. Its Request for Information advises, "there is no guarantee that a reverse auction for cellulosic biofuels will be supported as a result of this RFI."

The Institute for Local Self-Reliance does not oppose the use of incentives to accelerate the commercialization of cellulosic ethanol, even if the acceleration would be modest. We do believe, however, that since the Act's incentives will not significantly accelerate its quantitative goals, they should be used primarily to achieve its qualitative goals : maximizing the benefits of cellulosic ethanol production to the nation's farmers and rural communities. For here they could have a significant and perhaps even a determining impact.

Since the Act's incentives will not significantly accelerate its quantitative goals, they should be used to achieve the Act's qualitative goals.

Achieving the Act's Qualitative Objectives

The Act contains very explicit qualitative objectives. Section 942 requires that suppliers "demonstrate outstanding potential for local and regional economic development." A priority is to be given to projects "that include agricultural producers or cooperatives of agricultural producers as equity partners in the ventures; and… have a strategic agreement in place to fairly reward feedstock suppliers."

With regard to the reverse auction, the Act allows the Secretary of Energy not to award contracts to the lowest bidder, but rather to the bidder who can best achieve the qualitative as well as quantitative objectives of the Act.

To achieve these qualitative objectives -- maximizing the beneficial impact of cellulosic ethanol production on farmers and rural communities -- DOE should fashion a program that nurtures local ownership and geographic diversity.

Local ownership dramatically increases the beneficial local economic impact of a new biorefinery.

In the case of corn-to-ethanol, a new plant may raise the price local farmers receive for their corn by 5-15 cents per bushel. Farmers who own a

share in the ethanol facility, on the other hand, typically earn 50-75 cents per bushel in annual dividends. Thus a farmer-owned 40 million gallon facility could generate $10 million more each year in direct local economic benefits than an absentee owned plant of the same size.

The disparity between the local and producer benefits of locally owned versus absentee owned cellulosic ethanol facilities may be even greater because of the lower selling price of cellulosic feedstocks compared to the final selling price of the ethanol.

DOE should use the Act's financial tools to nurture a minimum of 15 cellulosic ethanol plants in different regions, using at least 4 different feedstocks. This would allow the wide array of experimentation and demonstration necessary at this, the beginning of the cellulosic ethanol era.

A farmer-owned 40 million gallon facility could generate $10 million more annually in direct local economic benefits than an absentee owned plant of the same size.

All of these incentives should focus on maximizing the benefit to producers of the feedstock and the rural communities in which the processing facilities are based. In most cases this would require at least a majority farmer or local ownership, although arrangements for sharing with farmers and rural communities revenue from royalties from the licensing of new technologies could be taken into account.

DOE should use the grant money in Sections 933, 1511 and 1512 to offer an incentive of $6 per gallon for the first 500,000 gallons produced. The Act limits the payment to 60 percent of the facility's costs. Thus, this assumes a pilot plant cost of about $5 million ($10 per gallon). Financing 15 pilot plants would cost $45 million.

In addition to the reverse auction, Section 942 requests the Secretary of Energy, in consultation with the Secretary of Agriculture, the Secretary of Defense and the Administrator of EPA, to "establish an incentive program for the production of cellulosic biofuels." The program would offer "set payments per gallon" for "eligible entities" for six years. The Act gives the Secretary leeway in developing criteria to determine what entities are eligible.(These incentives are phased out once the nation produces 100 million gallons of cellulosic ethanol or by August 2008, when the reverse auction would go into effect.)

Either the direct incentive program or the reverse auction should favor small, diverse, farmer and locally owned facilities. The design of a direct incentive program might be similar to that of Minnesota's state ethanol incentive: a direct per gallon payment for a limited number of years for a limited output per year.

We recommend a 50-cent per gallon 6-year incentive for the first 5 million gallons produced each year. This could be given directly or could be awarded as part of a reverse auction process. (A reverse auction may reduce the price of a product when many producers compete. But given the very small number of cellulosic ethanol producers that will be capable of bidding in 2008, a reverse auction is unlikely to generate significant savings compared to a direct predetermined incentive.)

At $15 million per facility ($2.5 million per year for 6 years), a total of $225 million would be needed to finance 15 facilities that would collectively produce at least 75 million gallons per year.

The seed money would allow small commercial scaled plants using different feedstocks from several different geographic regions, and various processing technologies. The reverse auction or direct incentive would allow for the scaling up of the 500,000 gallon plant to a 5 million gallon per year plant.

Loan guarantees could help build a larger commercial scaled facility that will reduce the per gallon cost of cellulosic ethanol.

A brief word about scale economies

The RFP for biorefineries issued by DOE in February 2006 requires a minimum capacity of 18 million gallons a year. The Energy Policy Act requires a minimum 30 million gallon per year output from applicants for loan guarantees. The 30 million gallon per year minimum is too high, even though it is unclear, given that it is written into the statute, whether DOE has the authority to reduce it.

DOE should use the Act's grant money to finance start-up facilities, the direct incentives and/or a reverse auction to scale up these facilities and the Act's loan guarantees to encourage larger scale plants.

Large plants (e.g. over 30 million gallons per year) have economies of scale that allow them to produce ethanol at a lower cost. However, the engineering economies of scale can be offset by the diseconomies of scale related to purchasing feedstock from distant suppliers.

More importantly, the savings from building a few large plants are insignificant compared to the benefit of many smaller plants validating a wider array of technologies and feedstocks. Finally, the equity for small plants can more easily be gained from local resources, thereby enabling the facility to be more rooted in the community and a larger proportion of the revenue generated by the facility staying inside the region.

The first cellulosic ethanol plants will be more expensive per gallon of ethanol produced than their successors as the engineers move through their own learning curve. Better to pay that higher cost on the lower output of a smaller plant.

The goal of the Energy Policy Act is to commercialize cellulosic ethanol in a way that allows for the greatest economic benefit to the widest sections of the country. The Act itself contains all the tools necessary to achieve that goal. DOE should fashion a policy that weaves the different elements together into a cost-effective program achieves the Act's qualitative as well as quantitative goals.

ILSR's formal response to DOE's Request for Information was submitted July 13, 2006. This is a slightly revised version.

David Morris is Vice President of the Institute for Local Self-Reliance. He has been a consultant or advisor to the energy agencies of Presidents Ford, Carter, Clinton and George W. Bush. He served from 2000-2005 on the Congressionally-created Biomass Research and Development Technical Advisory Committee to the U.S. Departments of Energy and Agriculture. He is the author of several books, including *The Carbohydrate Economy*.

The **Institute for Local Self-Reliance** is a nonprofit research and educational organization that provides technical assistance and information on humanly-scaled, sustainable economic systems. Since 1974, ILSR has worked with citizens, governments and businesses in developing policies that extract the maximum value from local resources.