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TECHNICAL PAPER

Energy Security

A Strategy Brief on US Ethanol Markets and Policies

ANNETTE HESTER

Technical Paper No.1
March 2007

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* This paper is a follow-up to, Annette Hester, "A Fresh Approach to US Energy Security and Alternative Fuels: The Western Hemisphere and the Ethanol Option," CIGI Working Paper, no. 10 (October 2006).

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Abstract

The ethanol market in the United States is undergoing a rapid increase, affecting many sectors of the national economy. Consensus among all stakeholders is that priority must be given to the development of cellulosic ethanol and other technologies capable of delivering a safe and effective biofuel, to address the growing US energy security dilemma. The development of a new biofuels market that will combine ethanol production from traditional and innovative crops with new alternative fuel technology presents exciting opportunities and challenges. This paper examines the current developments in the ethanol market - both economic and political - and attempts to show where the synergies lie between US producers' best strategies and achieving energy security.

1. Introduction

In the time since the *CIGI Working Paper*, "A Fresh Approach to US Energy Security and Alternative Fuels: The Western Hemisphere and the Ethanol Option," was published, in October 2006, the ethanol market in the United States has boomed, increasing the price of corn, an American food staple, to a point where its impact has been significant enough to be felt throughout the economy. There is now, only five months later, a consensus among all stakeholders - government, corn producers, ethanol producers, scientists, environmentalists, oil companies, entrepreneurs, and institutional investors - that priority must be given to the development of cellulosic ethanol[1] and other technologies capable of delivering a biofuel that does not compete with food supply, and is economic as well as environmentally sustainable. The development of a new biofuels market that will combine ethanol production from traditional and innovative crops with a brand new universe in fuel technology presents exciting opportunities and challenges. The road forward has many forks, and there are many drivers, each attempting to ensure that the final resting place is closest to their own home.

The motor driving this journey continues to be the US' search for energy security. So far, the three-fold increase in ethanol production in the last six years has had a negligible impact on total fuel consumption. Ethanol use has risen from 1.2% of total gasoline demand in 2000 to 3.5% in 2006. Despite the hefty federal incentives so far - representing an estimated $14.5 to $18 billion in forgone tax revenues between 1979 and 2005 (roughly equivalent to $558 to $700 million per year)[2] - progress towards achieving energy security has been disappointing.[3]

Steering the country in a new direction therefore makes much of the driving an uphill journey for US policy makers, farmers, and industry. This paper will examine

[1] Cellulosic ethanol is a type of ethanol that is produced from a great diversity of biomass including waste from urban, agricultural, and forestry sources. Unlike normal ethanol, whose original raw material are sugars and starches, cellulosic ethanol's starting raw material is cellulose. For common definition, see: <http://en.wikipedia.org/wiki/Cellulosic_ethanol>.

[2] Spending on biofuels research, by comparison, amounted to an estimated $85 million per year for the last five years.

[3] According to the United States General Accounting Office, the ethanol excise tax exemption reduced revenues from the Highway Trust Fund by an estimated $7.5 to $11 billion from FY1979 to FY2000. Given that estimates for the 2001-2005 period are not available, a "back of the envelope" calculation was made by multiplying the total ethanol production of 13.9 billion gallons by the tax credit of $0.51 to arrive at the rough figure of $7 billion.

the current developments in the ethanol market - both economic and political - and attempt to show where the synergies lie between US producers' best strategies and achieving energy.

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2. The Production

US domestic ethanol production went from 1.63 billion gallons a year (bbg/y) from 54 plants in 2000; to 3.9 billion gallons a year from 81 plants in 2005; and to 4.9 bbg/y from 95 plants in 2006.[4] Forecasts for 2007 are for production to increase to 5.4 bbg/y from 113 existing plants.[5] Moreover, according to Bob Dinneen, President and CEO of the Renewable Fuels Association, another 78 new plants are under construction.[6] Most of this current production (75%) comes from the five states that make up the Corn Belt - Iowa, Nebraska, Illinois, Minnesota, and Indiana, and although production has historically been concentrated in the hands of few producers, the current trend is towards a much more diluted market. Nonetheless, data from the Renewable Fuels Association shows that the top ten producers account for almost 50% of total production. Archer Daniels Midland (ADM) alone accounts for 20% of this capacity.[7]

Feedstock demand for these plants has shifted the share of corn output dedicated to ethanol from 14% of US total corn production in 2005 to almost 20% in 2006.[8] Estimates are for this trend to continue. Fortunately, corn yields have increased. Since 1948, according to the United States Department of Agriculture (USDA) chief economist Keith Collins, "corn yields have increased four-fold, from 40 bushels per acre to 160 bushels in 2004… [and] it does appear that corn yields in the past

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[4] Renewable Fuel Association: <http://www.ethanolrfa.org>; and Chad Hart, "Biofuel Impacts on Midwestern Agriculture," Presentation to the *2007 Wisconsin Fertilizer, Aglime and Pest Management Conference*, Madison, Wisconsin, 16 January 2007.

[5] Timothy Egan, "Life on the Ethanol Guzzling Prairie," *New York Times*, 11 February 2007.

[6] Bob Dinneen, Deposition to the United States Senate, 1 February 2007.

[7] Renewable Fuels Association, "US Fuel Ethanol Industry Plants and Production Capacity," January 2007.

[8] Keith Collins, "US Agriculture and the Emerging Bioeconomy," Presentation of the United States Department of Agriculture Chief Economist, 12 October 2006.

two years have moved above the long term trend." At the same time, the USDA expert adds, "genetically engineered varieties have gone from 25% of corn acres in 2000 to 61% this year."[9]

All this activity is translating into an escalation of costs.

Informed estimates are that ethanol plant costs of US$100 million have almost doubled in the last two years.[10] In the absence of an existing pipeline gathering and transportation infrastructure, part of the expense is attributed to the need to build appropriate rail transportation terminals in each plant. According to a recent Wall Street Journal article, ethanol producers are being forced by railroad companies, who are already working at capacity, to build their own storage and purchase their own cars. One producer noted that although he was only doubling his production capacity, he had to triple the size of his rail yard - incurring costs of $500,000 for the land and an additional construction cost overrun of 75%.[11]

In addition to a significant increase in capital costs, operating costs have also ballooned. Corn prices, the most important production input, have gone from approximately US$2.30 a bushel in September 2006 to a record high US$3.85 last December.[12] Furthermore, transportation costs from the Midwest to either eastern or western markets are another significant input. However, the increase in corn prices is offset by the existence of co-products in the ethanol production cycle. There are a number of outputs other than ethanol - mostly animal feed, but also some corn oil production, all of which have also seen a rise in prices. Nonetheless, without the US$0.51/gallon subsidy,[13] corn ethanol would not currently be economically viable.

New Developments

Moving beyond the food versus energy dilemma, still within the traditional corn ethanol production cycle (as opposed to cellulosic), there are two new initiatives

[9] Ibid.
[10] Author's Personal Communication, 30 January 2007.
[11] Ilan Brat and Daniel Machalaba, "Can Ethanol get a Ticket to Ride," *Wall Street Journal*, 1 February 2007, B1.
[12] Hart, "Biofuel Impacts on Midwestern Agriculture."
[13] Pure ethanol used in blending receives a federal income tax credit of US$0.51 per gallon as well as a number of other subsidies that vary from state to state.

worth some attention: The E3 Biofuels plant in Mead, Nebraska and the Panda Ethanol plant in Hereford, Texas. Both plants capitalize on the synergies between ethanol and livestock production, while testing the cost efficiencies of locating an ethanol plant close to end users of both ethanol and its by-products. Although there are additional costs in transporting corn that are more expensive than transporting ethanol, these production facilities are environmentally benign. Cattle manure provides all the energy the plants need, while the plants provide all the feed the cattle need. A comprehensive discussion of these two plants can be found in a recently published article by Chad Hart and Miguel Carriquiry.[14]

The Road Ahead

Central to the issues facing policymakers and producers are the projections for 2007/2008 and 2008/2009 increases in ethanol production and the associated impact this would have on the acreage dedicated to the corn harvest. Current ethanol-producing capacity is estimated to be 5.4 bbg/y, and planned expansions and new construction have led to projections of capacity reaching 11.4 bbg/y by 2009.

Meeting combined ethanol and food demands for 2007 will require a drawing down of existing stock by almost 1 billion bushels.[15] Further, given current yields, a one billion-gallon increase in ethanol production is associated with a 2.5 million-acre increase in corn production. In other words, to increase production and replenish the stocks will require substantial amounts of land and uniform high yields. That can be achieved by either substituting corn for other crops (particularly soybeans), or expanding planting to lands currently considered marginal. Either way, there are consequences.

In the first case, the soybean market will be affected. In the second case, the more marginal land that is added, the more fertilizer and care to ensure environmental sustainability it will require - even though, in the long run, new varieties engineered for poor soils could be introduced. Consequently, chances are that the average yield will decline. Both these developments are sure to affect corn prices, feed prices,

[14] Chad Hart and Miguel Carriquiry, "Ethanol-Livestock Integration," *Iowa Ag Review*, vol. 13, no. 1 (Winter 2007).
[15] Keith Collins, Author's Interview with the United States Department of Agriculture Chief Economist, 5 February 2007.

and all other substitution crops, particularly soybeans. In turn, their effects will be felt all the way down the food chain.[16] This scenario underlines the enormous challenge posed by realizing the potential of increased ethanol production: agriculture commodity prices are likely to increase and become more volatile.

3. The Markets

Spurred by high oil prices, tight refinery capacity, the mandated use of renewable fuels, and the phase-out of methyl tertiary-butyl ether (MBTE), a competitive oxygenate, US domestic ethanol demand went from 2.2 bbg/y in 2002 to 3.5bbg/y in 2004, and to an estimated 5.5 bbg/y in 2006. In each of those years imports made up the difference between domestic production and demand. Imports, mostly from Brazil, were 46 million gallons a year (mmg/y) in 2002, 161 mmg/y in 2004, and 618.12 mmg/y in the first 11 months of 2006.[17] Interestingly, following a change in relative prices (sugar cane ethanol price increased relative to corn ethanol) imports dipped in 2005 to 135 mmg/y. The surge in 2006 is explained by the industry's mismanagement of the MTBE phase-out.[18]

In terms of total demand, it is useful to segregate demand into E10 (90% gasoline and 10% ethanol) and E85 (85% ethanol and 15% gasoline). It is fair to say that for the next few years, until cellulosic ethanol is fully developed and incorporated into the supply system, it will be extremely difficult to establish a buoyant market for E85, except for very localized markets near production regions. That follows from the significant investments needed in transportation and distribution networks, and in increasing the number of Flex Fuel Vehicles (FFV) in the US vehicle fleet (currently there are approximately 6 million FFV). Moreover, further adjustments would be needed to deal with smog issues in California, and cold-start challenges in the colder parts of the country.

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[16] For a comprehensive discussion of this subject see Keith Collins, "Statement of Keith Collins, Chief Economist, USDA, before the US Senate Committee on Agriculture, Nutrition, and Forestry," Washington, DC, 10 January 2007.

[17] There is an import duty on ethanol of 54 cents a gallon, plus a 2.5% ad valorem tariff. Exemptions exist for some product produced in and imported from the Caribbean, under the Caribbean Basin Initiative.

[18] Although the 2005 Energy Policy Act clearly specified that there would be no liability protection against MTBE water and soil contamination, the industry still held hope that protection would be offered and did not prepared adequately for the phase-out.

The Blended Market

For the time being, it makes sense to concentrate on the market for blended gasoline. Given the approximately 140 billion gallons of gasoline consumed in 2006, one can set the immediate upper limit of this market to be 14 bb/g for E10. And even higher blends can be envisioned, such as E20, whose usage has been mandated by the State of Iowa by 2013. Nevertheless, there are three obstacles that have to be overcome.

1. Manufacturers will only guarantee the safety and usage of the current vehicle fleet to a maximum ethanol blend of 10%. However, a number of new models have the capability of running on E20.

2. On blends higher than E10, there are tailpipe emission and vehicle engineering issues that need to be dealt with.

3. Adapting the new fleet to a Flex Fuel standard would cost only a few hundred dollars per unit, including the possibility of installing this technology on hybrids. However their efficiency would decline proportionate to an increase in the ethanol content of the gasoline (because ethanol is less efficient than gasoline). That would defeat the higher-efficiency goals planned through widening and increasing the Corporate Average Fuel Standards (CAFÉ).

The Economics

Price is crucial for encouraging a healthy demand. An analysis presented by Brent Yacobucci of the Congressional Research Service, comparing the price of ethanol (pure) with gasoline and using prices from October to December 2006, found that ethanol is only competitive with gasoline if the US$0.51/g tax incentive is included, and even then, only at the lower price range. (The study shows the lowest and the highest price during the three month period.) Moreover, the first result was based on volume. When you base the price on the equivalent energy provided (ethanol delivers only 65%% of the energy that the same volume of gasoline would), ethanol is more expensive, even with the subsidy, at all price levels.[19]

[19] Brent D. Yacobucci, "Fuel Ethanol: Background and Public Policy Issues," *CRS Report for Congress*, updated 24 January 2007.

The U.S. market could also be outflanked by the competition from Brazil, which at current sugar cane prices, including the import tariff and transportation, can deliver ethanol on the East Coast at US$1.75/g - cheaper than the US$1.90/g that US ethanol producers demand when corn is at $3.70 a bushel[20] - and a softer oil market. Oil prices have slid to an average US$53/barrel in January 2007, from the US$66 average for 2006.[21] An earlier rise in renewable mandates (from the current 7.5 billion gallons by 2012) could alter this prospect, but some markets might still choose the cheaper Brazilian product.

4. Cellulosic Race

As mentioned in the introduction, consensus has emerged on cellulosic ethanol as the only economically and environmentally viable, and possibly the fastest, way to incorporate biofuels (read ethanol) into the fuel mix. As the name indicates, the product can be derived from any cellulosic material through either chemical or biochemical processes, or a combination of the two. That means that you could produce both food and ethanol from the same crop. Moreover, unlike the mixed opinions regarding the environmental benefits of corn-derived ethanol, there is complete agreement that cellulosic ethanol will deliver substantial reductions on emission compared to gasoline. With so much at stake, the race to become the leader in cellulosic ethanol production has brought together traditional petrochemical and oil producers, agriculture-based industrial producers, and venture capitalists.

Significant research funds and loan guarantees are already available. The Energy Policy Act of 2005 allocated US$160 million for the 2006 fiscal year towards financing commercial cellulosic production. Some thirty companies are competing for these funds, including the ethanol majors - ADM and Abengoa Bioenergy, a subsidiary of Spain's leading ethanol producer. However, Canadian Iogen, which has partnered with Royal Dutch Shell and Goldman Sachs, seems to have the lead, as it is the only contender that has an operating pilot plant in North America.[22] Two other Canadian firms, Greenfield Ethanol and SunOpta Inc, have teamed up to develop a commercial-

[20] Lauren Etter, "Meanwhile, Imports are Rising," *Wall Street Journal*, 1 February 2007, B1.
[21] Energy Information Agency, Weekly Petroleum Report: <http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/weekly_petroleum_status_report/current/txt/table14.txt>.
[22] Annette Hester, "A Fresh Approach to US Energy Security and Alternative Fuels: The Western Hemisphere and the Ethanol Option," *CIGI Working Paper*, no. 10 (October 2006): 30.

scale plant that will produce ethanol from wood chips.[23] DuPont is also in the race, investing millions in a new bio-refinery that will be fueled by corn stover, and will produce a product with higher carbon content alcohol called butanol. There are also several startups. Worthy of note are the efforts of Vinod Koshla, the founder of Sun MicroSytems, now turned venture capitalist and the nation's number one advocate for ethanol, especially cellulosic ethanol.[24]

There is plenty of evidence that the increased funding can bring cellulosic ethanol to markets in less than the ten years most scientists believe is feasible. The odds are that there will be more than one winning technology. This, in fact, would be the preferable outcome, since different crops and locations require a variety of different processes. There will be great incentive to adapt existing sugar cane and corn ethanol production facilities to the new cellulosic technology, ideally creating the capacity to produce both agricultural crop and cellulosic ethanol. Ultimately, the objective is making the product competitive with gasoline. The Natural Resources Defense Council, predicts that cellulosic ethanol could be delivered at US$0.59 to US$0.91 per gallon by 2012 with mature technologies.[25]

Some Associated Challenges

Full implementation and production of cellulosic ethanol will divide the market between producing regions capable of supplying large demand, and smaller production centers aimed at local markets. It is still too early to picture the infrastructure that will be needed to move this product from the producer to a blending terminal or to an E85 distribution system. However, although until now the American petroleum industry maintains that ethanol and blended gasoline cannot "generally" be transported via pipeline,[26] it is likely that, in time, the pipeline companies will follow the Brazilian example and learn to deal with the challenges brought about by ethanol's high corrosion factor and water content.[27]

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[23] GreenField Ethanol: <http://www.greenfieldethanol.com>

[24] Khosla Ventures: <http://www.khoslaventures.com/resources.html>

[25] Yacobucci, "Fuel Ethanol," 10.

[26] American Petroleum Institute, "Ethanol Overview," PowerPoint presentation, January 2007.

[27] Although it is correct to say that you cannot transport crude oil and ethanol in the same pipeline, Brazilian, Transpetro, does transport ethanol and gasoline on the same pipeline but in different batches, Marcelino Gomes, the company's director, claims that the additional operational costs are minimal. However, he declined to share specifics on those costs.

There is a great deal of debate on how much biomass and associate land will be needed to produce significant volumes of biofuels. So far there appear to be two very polarized camps: pessimists say it is not doable, while optimists are confident that biomass could supply "68 billion gallons of gasoline equivalent fuel, which is about half of the current light duty fuel consumption in the United States."[28] Some estimates, such as the ones calculated by Mr. Khosla, even project that biofuels can supply all of the country's gasoline needs by 2030.[29] Without wanting to engage in a valuation for which I am not qualified, two observations can be made:

1. Claims that there is enough land in the US for biomass to supply 50% or even all of the US gasoline needs might be technically true. But following this route is not necessarily desirable. A significant dependence on one single type of fuel -domestic or imported - especially one derived from agriculture feedstock, for which stable supply is conditioned by the vagaries of an increasingly unstable climate, is likely to deliver the exact opposite of energy security.

2. At the extreme, assumptions are being made that lands currently used for food exports will be converted to the production of energy crops in order to achieve higher production quantities. It is unclear whether the proponents of this idea fully comprehend the global implications. The US has spent the past decades ensuring that the country is one of the world's food providers, so much so that it is currently the world's leading corn exporter. According to USDA, global consumption of corn rose to a record 723.3 million metric tons in 2006 from 698.7 million the previous year. This represents the sixth time in the last seven years that consumption has exceeded production.[30] Consequently, a lowered US profile in the world markets, or withdrawal, would significantly impact supply and possibly price, at least until the markets adjusted and other producers, such as Argentina, stepped up to the plate. The recent "Tortilla Crisis" in Mexico, where newly elected president Felipe Calderon had to impose price controls on

[28] Lynd, et al., "Energy Myth Three -- High Land Requirements and An Unfavorable Energy Balance Preclude Biomass Ethanol From Playing a Large Role in Providing Energy Services," in Benjamin K. Sovacool and Marilyn A. Brown, eds, *Energy and American Society -- Thirteen Myths* (Dordrecht, The Netherlands: Springer, 2007).
[29] Vinod Khosla, "Is Ethanol Controversial? Should it be?" Draft Paper, September 2006, Appendix A - "Ethanol Production Capacity & Acreage Capability for Energy Crops."
[30] Jose Rasco and Richard Bernstein, *Global Agriculture: A Thematic Investing Report* (New York: Merrill Lynch, 24 January 2007).

tortillas, a staple of the Mexican diet, to deal with the sharp increase in corn prices resulting from the diversion of US corn supplies to ethanol production serves as a warning. Turning the US into a global player in some sectors while abdicating responsibility in others would lead to even more strife and world instability - from energy insecurity to general insecurity.

Finally, from a "public good" perspective, there is questionable advantage in exchanging dependency on one group of suppliers (oil companies) to another (agri-business). Although cellulosic ethanol could be delivered by a multitude of farmers and producers, history shows that the magnitude of US demand is such that economies of scale always lead to conglomeration, especially in areas demanding significant capital outlays. Moreover, it is worth noting that agriculture lobby groups have been responsible for the impasse between the developing and developed world at the Doha Round of world trade talks. Consequently, concentrating market power in the hands of a special interest group offers questionable benefits.

5. The Politics

The November 2006 US mid-term elections shifted the balance of power from the Republicans to the Democrats, who now control both houses. With that, the energy file has become a favourite topic for politicians, not to mention potential presidential candidates. Every legislator is intent on demonstrating a commitment to energy security and a cleaner environment through the increased use of alternative fuels. Parallel to that is the new attention paid to demand, compared with the previous concentration on supply. Although these might be laudable goals, the politically competing proposals, could create a piecemeal approach that might produce counter-productive results.

On the Table

Following from the goal expressed in the President's 2006 State of the Union Address, of increasing the usage of renewable fuels, and particularly of making cellulosic ethanol "practical and competitive within six years,"[31] the Department of Energy (DOE) has expanded research on biofuels. As part of the proposed FY 2007

[31] George W. Bush, *State of the Union Address*, 31 January 2006.

budget, a request has been made for an increase of 65% above last year's funding for "Biomass and Biorefinery Systems R&D" which includes cellulosic ethanol.[32] However, with the imminent renewal of the Farm Bill, the biofuels file seemed to have moved from the DOE to the Department of Agriculture (USDA).

When Mike Johanns, the US Secretary of State for Agriculture, unveiled his department's 2007 farm bill proposals on 31 January, it included the provision of "$1.6 billion in new funding for renewable energy research, development and production, targeted for cellulosic ethanol, which will support $2.1 billion in guaranteed loans for cellulosic projects and includes $500 million for a bio-energy and bio-based product research initiative."[33] In his 2007 State of the Union Address, President Bush proposed a 35-billion-gallon increase in the supply of alternative fuels by 2017.[34] However, this figure included a broader range of alternative fuels, including coal to liquids, angering the U.S. environmentalist lobby and prompting Secretary of Energy Samuel Bodman to qualify achieving the objective as a "stretch."[35] Moreover, judging by the proceedings of a recent conference on biofuels organized by the US Senate's Energy Committee,[36] senators have embraced the 25X25 (25% of alternative fuels by 2025) originally proposed by a coalition of US farm associations in 2004.[37]

Parallel to these initiatives, President Bush set in motion a plan to double the Strategic Petroleum Reserve, and suggested an increase and widening of the CAFÉ standards to "conserve up to 8.5 billion more gallons of gasoline by 2017."[38]

The US is not the only country prepared to invest meaningfully in the development of new biofuels technology. North of the border, the Canadian government just

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[32] Yacobucci, "Fuel Ethanol," 10.

[33] United States Department of Agriculture, Farm Bill, News Release: <http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1UH?contentidonly=true&contentid=2007/01/0020.xml>

[34] A mandated use of 7.5 billion gallons of renewable fuels by 2012 is part of the Renewable Fuels Standards of the Energy Policy Act of 2005.

[35] *Platts Oilgram*, "US Renewable Fuels Goal 'a stretch': Bodman," 8 February 2007.

[36] United States, *Transportation Biofuels Conference* (Washington, DC: US Senate Committee on Energy and Natural Resources, 1 February 2007).

[37] The original proposal read "Agriculture will provide 25% of the total energy consumed in the United States by 2025 while continuing to produce abundant, safe and affordable food and fiber." Ag Energy Working Group, *25x25 Agriculture's Role in Ensuring US Energy Independence: A Blueprint for Action* (Washington, DC: Energy Future Coalition, August 2004).

[38] George W. Bush, *State of the Union Address*, 23 January 2007.

announced a new initiative, the Canada EcoTrust, consisting of C$1.5 billion of new funding on a national basis. Cellulosic ethanol production is expected to receive a significant portion of these funds.[39]

The Law of Unintended Consequences

For the ethanol industry, these initiatives are great news, and they justify the "full speed ahead" approach. However, as mentioned above, much of the demand will be supplied by existing ethanol producers at the rates production is set to increase even by 2009, Consequently, unless further mandates are enacted, particularly differentiating tax credits and special treatment for cellulosic ethanol, it will be difficult to make the product economics attractive enough to guarantee investments at this earlier stage.

In cases where ethanol productivity from the conventional feedstocks is greatly increased, and consequently cost is further reduced, cellulosic ethanol may also face greater barriers to becoming economically attractive. This scenario would be of less importance if the product becomes an additional by-product of the production mix as, for instance, ethanol from sugarcane bagasse or from corn stover. The baseline for competitiveness, however, seems to be the price of oil.

Refiners will be caught in the middle. As Frank Verrastro, head of the energy group for the Center for Strategic and International Studies (CSIS) in Washington points out, although the 2005 Energy Act called for increased investment in the refining sector, given the prospect of reduced demand for petroleum based transport fuels, one questions whether such investments will proceed. Further, if refining expansions do not take place, enlarging the Strategic Petroleum Reserve (SPR) is of limited consequence since consumers require refined products not crude oil. As evidenced by the product shortages in the aftermath of hurricanes Katrina and Rita, delivering additional crude without having adequate process capability results in greater reliance (short term) on product imports, so maybe it would be more prudent to look at ways to increase product stocks.[40]

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[39] Stephen Harper, "Prime Minister unveils new Canada EcoTrust," Press Release (Ottawa: Prime Minister's Office, 13 February 2007).

[40] Frank Verrastro, Author's Communication, 5 February 2007.

Furthermore, the single-minded preoccupation with Middle East supply is misguided. In 2005 the region only accounted for 16% of imports (Saudi Arabia alone was responsible for 11%) and 12% of US total demand. In contrast, suppliers in the Western Hemisphere - Canada, Mexico, and Venezuela - were responsible for 40% of total imports. Logic dictates that the search for energy security should concentrate on tapping new reserves in the hemisphere or, at a minimum, developing better cooperation between existing hemisphere suppliers and consumers. The recent visit by US Under-Secretary of State for Political Affairs Nicholas Burns, Assistant Secretary for Western Hemisphere Affairs Tom Shannon, and International Energy Coordinator Greg Manuel to Brazil to discuss an alliance on ethanol is a good step. Optimists envision the signing of an agreement between the U.S. and Brazil to develop alternative fuels and encourage new production by year-end. However, it will be interesting to see whether the Bush administration secures domestic support for such an initiative. So far, the discourse has been one of isolation and protection.

Finally, the US and Canada are competing to see who can offer more funds to industry rather than joining forces in the kind of partnership being proposed with Brazil. If these two governments decided to work together, they could jointly fund cellulosic ethanol development and a number of other initiatives such as carbon sequestration and clean coal technology. Unfortunately, Canadian policymakers so far do not seem interested in exploring this possibility with their American counterparts.

6. Putting it All Together

Clearly, the road ahead is full of twists and turns, hills and valleys, and hidden hazards. At every intersection there are decisions to be made: turn right, turn left, or stay the course. Here are some road signs to help along the way:

On Production

- Big producers would be wise to diversify production locations. Much like oil companies, who use a global approach to capitalize on diversity and thus reduce costs of capital, the big US ethanol producers need to become global ethanol producers. Investing in the US and Brazil simultaneously and paving the way for America's regional integration through a "clean and renewable fuel initiative" is a good way to start.

- As capital and operating costs increase, small producers will face great challenges in staying profitable if oil prices decline and find a lower floor. In this scenario there will be great opportunity for consolidation leading to a return to the historic trend of conglomeration. Nonetheless, it is possible to envision that conglomeration could also take the form of regional cooperatives of small and medium producers.
- Low oil prices would also weaken the government's resolve of keeping energy security in the forefront of issues relevant to Americans. Instead, the costs associated with support and protection for biofuels combined with the impact on food prices that are sure to come until markets adjust and cellulosic ethanol comes into production will make continuous government support for this agenda a challenge.
- The public is also likely to become increasingly concerned with environmental degradation caused by the escalating use of marginal lands to augment corn production acreages. Once attention to this issue gains momentum, it will be hard to stop. That might have the effect of forcing all levels of government to regulate according to their jurisdiction – water use, conservation, waste disposal, etc – which will further increase operating costs. The acceleration to secure markets might then backfire.
- The current "full speed ahead" approach will also deliver an installed infrastructure capacity for approximately 10% of the gasoline market - and one that is not necessarily the most efficient. However, once it has been built, it will take another huge leap in production to make the economics of a more efficient system - such as pipelines - possible. The economic implications of this development for the three decades that it takes to depreciate the capital costs are far from being understood.

On Demand

- For the next few years, the US market is likely to reach a ceiling of approximately 14 bb/g. Given that the production from corn is expected to reach 11 bb/g by 2009, the market dynamics will have surpassed the mandated use of renewable fuels of 7.5 bb/g by 2012 much before that date. However, once ethanol completely replaces MTBE as an oxygenate, and given the fact that oxygenate use is no longer mandated, it is unclear how much product refiners will choose to use to compensate for tight gasoline markets, and at what price.

- If market dynamics continue to push corn prices up, while sugar cane prices remain stable, American producers could face competition from Brazilian product even with import tariffs and the existing subsidies. If that is the case, the chance for the tariff to be removed will be lost. In fact, there will be loud calls for the tariff to be increased. That situation would be exacerbated if oil prices find a new floor level.
- From a demand perspective it is also the best strategic position for large US ethanol producers to have production in Brazil. They could capitalize on the cost savings brought about by the efficient sugar cane production and have the flexibility of servicing their clientele in both coasts - East Coast from Brazilian production and West Coast from domestic production - at competitive price points.

The Cellulosic Race

- Undoubtedly there will be significant gains made by large corn ethanol producers if they can either develop cellulosic technology themselves or join forces with specialized technology developers to come up with a process that is cost effective in adapting current production capacity to this new technology.
- They could capitalize on these gains even further by concurrently testing and applying this new technology - for which there will be significant funding from the US government - in their Brazilian operations. Brazil can serve as the perfect testing ground as all systems are already in place (production, transport, distribution, and marketing).
- The same reasoning can be applied to smaller cellulosic ethanol producers.
- Moreover, this course of action would ensure that there is cooperation between developed and developing world, and that both advance at the same speed, bridging the divide. It could also act as a counterbalance for the forces that lead to power being in the hands of one group in one country.

On Politics

- Producers of cellulosic ethanol will be vigorously lobbying Congress for a differentiated treatment - not only in terms of the mandates, but also in terms of tax credits. But the best strategy for established ethanol producers is less clear.

- However, if they are well positioned, they will able to secure benefits, such as market access, through production both in Brazil and the US, and credits from producing cellulosic ethanol while using traditional crops as feedstock.
- The producers could make a case for special treatment for cellulosic product imported from Brazil on the grounds of a wider bilateral ethanol collaboration agreement, which would diffuse Venezuelan President Hugo Chavez's influence on the region, thereby fostering energy security.
- Also, with all the subsidies in place, it will be a long time before the US is in a position to export ethanol (and any attempt to export would be met by immediate complaints at the WTO for exports of subsidized commodities). Consequently, having an export platform from Brazil would give American producers access to the emerging global biofuels market.

In the end, it is worth remembering that energy security, or security of any kind, will never be delivered by isolation and protectionism. The "us against them" mentality only serves to foster ill feelings and resentment. As we construct a new road to a destination where people and the environment coexist in a more holistic way, it makes sense for this road to have many access points, to be traveled by many different types of vehicles, and to include drivers from many different places. Cooperation and inclusion must be the answer.

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