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BioEnergy

Fueling America Through Renewable Resources

Ethanol and Energy Policy

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EXPERT REVIEWED

Until recently, ethanol development and utilization have been largely dependent upon government subsidies. Without the $0.51 payment per gallon to blenders, ethanol was uneconomic. This changed in 2005 because of the combination of low corn prices ($2 per bushel), high oil prices, and the increased value for ethanol as an oxygenate when the petroleum-derived oxygenate, MTBE, was banned by many states. For the last half of 2005 and for 2006, ethanol production has been a money maker even without the $0.51 per gallon subsidy, and high profits have led to a frenzy of construction of ethanol plants and concerns that ethanol will consume a large share of the corn crop, drive prices up, reduce exports, and force other users to cut back corn use.

What Role for Ethanol?

The U.S. is not short of energy; we have vast reserves of coal. What we are short of is liquid fuels, and, just recently, natural gas as well. Ethanol can play a role in reducing our dependence on imported oil, which now accounts for over 60% of our liquid fuel consumption. We consume more than 140 billion gallons of gasoline a year. If we took an entire corn crop of 11 billion bushels and converted it to ethanol, this would yield about 30 billion gallons of ethanol with an energy content 70% that of gasoline, or 21 billion gallons of gasoline equivalent. This is roughly 15% of our gasoline use. We actually expect to be using about a third of our corn crop for ethanol in 2012—this will provide about 5% of our gasoline use in gasoline energy equivalents. Ethanol thus helps meet some of our liquid fuel needs, but it does not go very far in solving our dependency on imported petroleum, with its potentially high strategic cost. (Strategic cost represents the potential disruption or influence that can be exercised by foreign oil producers and the cost we pay monetarily and in foreign policy for keeping oil flowing to us from overseas.) The strategic cost to the nation of imported oil is probably two to over three dollars a gallon above what we pay for gasoline at the pump. Part of this strategic cost will have to be paid in the future in terms of the large foreign exchange deficits imported oil helps create.

Ethanol production is a prominent component of the Bush administration's supply-oriented energy policy. The bulk of the effort so far in dealing with our liquid fuel shortage has been focused on increasing the supply of liquid fuels. However, additional oil can be "created" by using less oil, which is just as effective as producing more. The key consideration then becomes cost. In taking either route, increasing supply or limiting demand, additional supplies (or savings) become more expensive the more one pursues that particular approach, as Figures 1 and 2 illustrate.

Figure 1. *Marginal Cost of Liquid Fuel Supply*

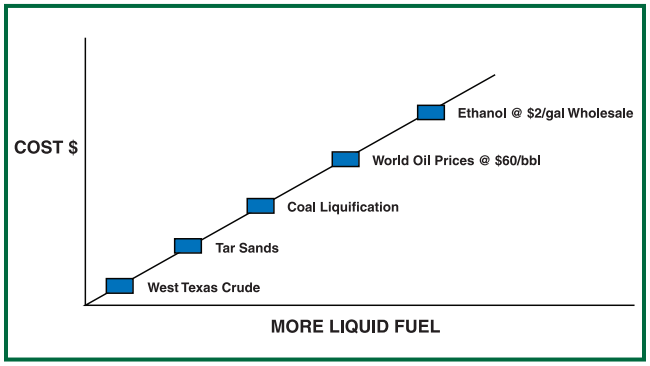
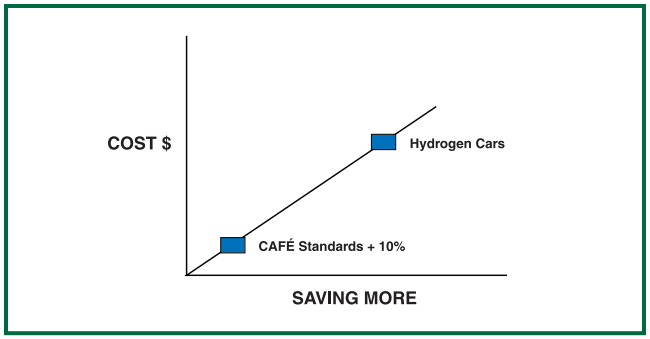


Figure 1 illustrates the supply we produce relative to cost when our goal is to increase supply. Note that an early petroleum source, like West Texas crude, is relatively inexpensive. Getting oil from tar sands and liquids from coal is more expensive, but less expensive than oil at a world price of $60 a barrel. In this example, ethanol is the most expensive at a wholesale price of $2 a gallon. Now compare this with the costs of creating additional oil by saving it, as illustrated in Figure 2.

Figure 2. *Marginal Cost of Liquid Fuel Saving (Replacement)*



In Figure 2, increasing the Corporate Average Fuel Economy (CAFÉ) or auto fuel efficiency standards is relatively inexpensive, and this is something that we have not yet done. The Congressional Budget Office estimates that raising the CAFÉ standards by 10% for cars and trucks would cost somewhere between 3 and 3.6 billion dollars (2003). If the government (taxpayers) were to pay that full cost, it would result in a saving of about 14 billion gallons of gasoline.

Compare this with the cost of the subsidy to produce an energy-equivalent amount of ethanol—some 20 billion gallons. The ethanol subsidy for the same liquid fuel saving as increasing the CAFÉ standards would cost the government over 10 billion dollars. What this says is that it would cost us about a third as much to increase the fuel efficiency standards per gallon of gasoline saved as it costs to subsidize ethanol per gallon of gasoline-equivalent ethanol. We also have the technology today to do this without everyone having to have mini-cars, although we might have to give up some of the muscle car acceleration we have desired in recent years.

Note in Figure 2 that the hydrogen car is probably an expensive way to obtain liquid fuel from reducing demand. The technology is expensive, and hydrogen is not going to be inexpensive to obtain. Today, most of the hydrogen we use comes from natural gas, which now is in short supply and is more costly to import. Hydrogen can be produced from electrolysis, but we do not have large amounts of extra-low-cost electricity available to do this. There are other liquid fuel saving activities that could be arrayed along this cost/quantity line, from more efficient oil furnaces in homes to better insulated houses where heating fuel is used to more use of rail transportation for freight.

Longer Term Issues

One recent study of future ethanol production sees ethanol plants being able to pay over $4 a bushel for corn for years to come and ultimately concludes that we will be producing over 31 billion gallons of ethanol by 2015 by utilizing all the corn that could be purchased up to this high corn price (Elobeid, Tokoz, Hayes, Babcock, and Hart, 2006). This would utilize 11 billion bushels of corn out of an estimated 15.6 billion bushel crop on 95.6 million acres, requiring corn to replace many soybean acres.

At this high corn price, exports and many other uses would be severely restricted. This is seen as a logical end point for

the expansion of the ethanol industry. However, continued pursuit of policy to stimulate corn ethanol production could lead to a boom/bust cycle for agriculture. This is especially true if the current biofuels incentives were to be redirected toward reducing demand.

Realistically, what are the longer term constraints for ethanol production? Looking at Figure 1, if we do have development of oil from tar sands at anything like the pace that is underway today, there will be large amounts of liquid fuels from the tar sands by 2015 in spite of the environmental and other difficulties of doing so. (Processing tar sands uses vast amounts of energy and water.) The same holds true for coal liquefaction. The critical questions here are what happens to the price of oil between now and 2015, and what policy does government adopt with respect to encouraging liquids from coal and oil from tar sands.

There could be a policy similar to that for ethanol, offering a subsidy of $0.50 to $0.70 a gallon for tar sand oil or liquids from coal. A less expensive alternative would be to have a subsidy that only is paid when the price of oil falls below a given price. Let's say the subsidy would kick in for coal liquefaction only when the price of oil went below $45 a barrel—a possible break-even point for coal liquefaction. Such a subsidy would probably cost about $0.15 to $0.25 a gallon and keep the coal liquefaction investment whole during drops in oil prices over the coming decade.

Using a variable subsidy for encouraging investment in energy projects costs the taxpayer less and reduces financial variability in the industry (Tyner and Quear, 2006). We know that a variable ethanol subsidy would have cost the taxpayer substantially less than the current per gallon subsidy and could have prevented the financial distress that the industry suffered in the mid 1990s, when corn prices reached $5 and gasoline prices were low. This variable subsidy idea is used today in agriculture with the loan deficiency payment, which only results in payments to farmers when crop prices fall below a fixed level.

Part of the reason for designing a policy to protect investment in domestic liquid fuel production is that such domestic production ultimately limits how much others can charge to sell us oil from overseas. We also need to recognize that those in control of the vast oil reserves overseas exercise monopoly power. Foreign producers might see it in their own best interest to lower the price of oil temporarily and make investment in domestic production or conservation uneconomic. The fall of oil prices in the late 1980s and early 1990s did just that. This is why few will invest in a 2 billion dollar coal gasification plant today without some profit guarantee.

Reasonable Actions and Their Consequences

Think in terms of where we might be in 2015 with respect to liquid fuels. Senator Lugar, as chair of the Senate Foreign Relations Committee, has pointed out that there are some things the market does not take care of by itself (2006). Our strategic vulnerability with respect to oil is one of these.

We are not now pricing liquid fuels to reflect their full cost to our society in terms of the blood and treasure we are expending to keep inexpensive gasoline flowing. In 1935, the cost of a thousand gallons of gas was 36% of average disposable income. A thousand gallons of the "cheap" gas of the 1950s and 60s cost 12% of disposable income, and the same amount at $2.10 today would cost 7% of average disposable income. However, our political, military, and economic vulnerability is vastly greater. Europe is equally vulnerable, especially with respect to natural gas from the Russia. However, they are pricing gasoline above $7 a gallon.

By 2015, we might have increased the CAFÉ standards by 15% and might be obtaining an actual 10% saving based on the more efficient cars in service. We as taxpayers might have shared the cost of this by subsidizing some of the cost of the new technology. Would people just drive longer distances and eat up the savings?

Unfortunately, that is what has happened in the past. If we protected the investment for tar sand development and coal gasification/liquefaction, we might have as much or more liquid fuel from these sources as the 10 billion gallons more realistically projected for ethanol. We also should have ethanol from cellulose conversion (Mosier, 2006). If this is less expensive than ethanol from corn, we should be seeing corn ethanol plants switching over to cellulose feedstock, limiting the use of corn for ethanol. These actions might allow us to hold the line in terms of the proportion of our liquid fuel we imported while still using more. Would this be enough?

What else might happen? If economic growth continues in India and China as it has recently, we will increasingly be limited in the amount of foreign oil that we are able to purchase. These countries are locking up supplies wherever they can around the world, and their demands for these fuels are increasing at a fast rate. China also has the foreign exchange earnings to purchase vast amounts of oil with

the dollars they earn from selling us manufactured goods. If this continues, world oil prices will be higher by 2015. We might even have the courage to try and limit our own demand growth with a higher gasoline tax that would make the inflation-adjusted price of gasoline two or three times what is was 50 years ago. Here the market, as influenced by the tax, would signal consumers and encourage decisions to use less and conserve more.

At really high petroleum prices further boosted by gasoline taxes, do we end up making 31 billion gallons of ethanol from corn? Probably not. The reason is that oil from tar sands, coal liquefaction, cellulose conversion, increased fuel efficiency, and conservation are all even more attractive options with oil at $120 a barrel plus a high gasoline tax.

Conclusion

What is clear is that there is no one action that significantly reduces our dependence on foreign liquid fuels, be it more ethanol, the development of coal liquefaction, or increasing the CAFÉ standards. A large number of things will have to be done simultaneously. The questions are what policies encourage many of these things to happen, and are we willing to undertake them now, or must we wait until the danger may be even greater?

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