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BIOFUELS

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Aside from rejecting biofuel expansion and use for environmental reasons (see Biofuels (Land and Water Concerns)[1] and Biofuels (Miscellaneous)[2] in our Subject Index), the production and use of biofuels from an economic perspective does not make much sense either.

Proponents of biofuels say their increased production will increase the supply of transportation fuels and therefore lead to lower prices. Critics of biofuels point out ethanol often costs more, not less, than gasoline, either because of production costs or supplies that can't keep pace with government mandates, and therefore leads to higher prices at least in the short run.

Ethanol has only two-thirds the energy content of gasoline, which makes it a poor value for most consumers. The production cost of ethanol (which is only one component in determining its price) has fallen as a result of technological innovation and economies of scale, but some properties of ethanol continue to make it expensive compared to gasoline. Transportation costs for ethanol, for example, are high because it picks up water as it travels through pipelines, diluting the ethanol and corroding the pipelines. Therefore, it has to be trucked to the Northeast and along the Gulf Coast. Ethanol must be kept in a different container at the terminal and is blended into the gasoline in the truck on its way to the retailer from the terminal. This has caused regional shortages, further increasing the retail prices in these areas (Dircksen, 2006).

Aside from rejecting biofuel expansion and use for environmental reasons, the production and use of biofuels from an economic perspective does not make much sense either.

Ethanol also has been promoted as a fuel additive to reduce emissions. It reduces carbon monoxide in older vehicles and dilutes the concentration of aromatics in gasoline, reducing emissions of toxins such as benzene. Because ethanol has only two-thirds the energy content of gasoline, however, it seriously reduces fuel economy, and increases the emissions of air toxins such as aldehydes. In some areas, the use of 10 percent ethanol blends may increase ozone due to local atmospheric conditions (Niven, 2004).

Ethanol also is promoted as a "homegrown" and renewable energy source, so using more of it could help reduce a country's dependency on foreign oil, which in turn might lead to positive

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1 http://www.co2science.org/subject/b/biofuelslandwater.php.
2 http://www.co2science.org/subject/b/biofuels.php.

effects on international relations. But ethanol used in the U.S. mostly supplants oil from domestic suppliers, which is more expensive than foreign oil, and leaves the country's dependency on foreign oil the same or even makes it higher (Yacobucci, 2006). Rural communities benefit from the economic boost that comes from higher prices for corn and the jobs created by ethanol plants, but those economic benefits come at a high price in terms of higher food prices and tax breaks financed by government debt or higher taxes on other goods and services.

Biofuel refineries compete with livestock growers and food processors for corn, soybeans, and other feedstocks usually used to produce biofuels in the United States, leading to higher animal feed and ingredient costs for farmers, ranchers, and food manufacturers. Some of that cost is eventually passed on to consumers. A study by the Congressional Budget Office (CBO) found "the demand for corn for ethanol production, along with other factors, exerted upward pressure on corn prices, which rose by more than 50 percent between April 2007 and April 2008. Rising demand for corn also increased the demand for cropland and the price of animal feed" (CBO, 2009). The CBO estimated that increased use of ethanol "contributed between 0.5 and 0.8 percentage points of the 5.1 percent increase in food prices measured by the consumer price index (CPI)."

A study by the Congressional Budget Office (CBO) found the demand for corn for ethanol production, along with other factors, exerted upward pressure on corn prices, which rose by more than 50 percent between April 2007 and April 2008.

Johansson and Azar (2007)[3] analyzed what they called the "food-fuel competition for bio-productive land," developing in the process "a long-term economic optimization model of the U.S. agricultural and energy system," wherein they found the competition for land to grow crops for both food and fuel production leads to a situation where "prices for all crops as well as animal products increase substantially." Similarly, Doornbosch and Steenblick (2007) say "any diversion of land from food or feed production to production of energy biomass will influence food prices from the start, as both compete for the same inputs. The effects on farm commodity prices can already be seen today. The rapid growth of the biofuels industry is likely to keep these prices high and rising throughout at least the next decade (OECD/FAO, 2007)."

Runge and Senauer (2007)[4] report corn-based ethanol in the United States *already* "takes so much supply to keep ethanol production going that the price of corn-and those of other food staples-is shooting up around the world." To put this in perspective, they write "filling the 25-gallon tank of an SUV with pure ethanol requires over 450 pounds of corn-which contains

3 http://www.co2science.org/articles/V10/N39/EDIT.php.
4 http://www.co2science.org/articles/V10/N39/EDIT.php.

enough calories to feed one person for a year." Rising prices caused food riots to break out in Haiti, Bangladesh, Egypt, and Mozambique in April 2008, prompting Jean Ziegler, the United Nations' "special rapporteur on the right to food," to call using food crops to create ethanol "a crime against humanity" (CNN, 2008). Jeffrey Sachs, director of Columbia University's Earth Institute, said at the time, "We've been putting our food into the gas tank-this corn-to-ethanol subsidy which our government is doing really makes little sense" (Ibid.). Former U.S. President William Clinton was quoted by the press as saying "corn is the single most inefficient way to produce ethanol because it uses a lot of energy and because it drives up the price of food" (Ibid.). Unfortunately, as the CBO report concluded a year later, corn is likely to remain the main source of ethanol for quite some time as "current technologies for producing cellulosic ethanol are not commercially viable" (CBO, 2009).

Bryan *et al*. (2010)[5] state first-generation biofuels are an existing, scalable form of renewable energy of the type "urgently required to mitigate climate change," which is an important thing to remember about their mindset in light of the findings and implications of their work. Continuing, Bryan *et al*. "assessed the potential benefits, costs, and trade-offs associated with biofuels agriculture to inform bioenergy policy." More specifically, they indicate they "assessed different climate change and carbon subsidy scenarios in an 11.9 million hectare region in southern Australia," where they "modeled the spatial distribution of agricultural production, full life-cycle net greenhouse gas (GHG) emissions and net energy, and economic profitability for both food agriculture (wheat, legumes, sheep rotation) and biofuels agriculture (wheat, canola rotation for ethanol/biodiesel production)."

The three Australian researchers report finding "biofuels agriculture was more profitable over an extensive area of the most productive arable land," producing "large quantities of biofuels" that "substantially increased economic profit." But they add the end result was "only a modest net GHG abatement" that had "a negligible effect on net energy production." In addition, they indicate the economic profit was largely due to "farm subsidies for GHG mitigation," and whatever benefits were accrued came "at the cost of substantially reduced food and fiber production."

Such findings suggest it is only on the most productive arable land that biofuel agriculture turns a profit; and that profit comes not from normal economic considerations, but from farm subsidies paid by the government or the population at large. And the usurpation of the most productive arable land for biofuel production means there is an additional cost of reduced food and fiber production, which results in higher prices for these essential commodities, which prices are also paid by the population at large. Furthermore, there is a negligible effect of biofuels on net energy production. Consequently, "if biofuels are to be embraced," as Bryan *et al*. comment in concluding their assessment of the issue, "additional policy design features and institutions are required to support farm subsidies." And for this fact to be admitted by scientists who feel that first-generation biofuels are urgently required says a lot about their brutal honesty in publishing their not-so-glowing findings about biofuel costs and effectiveness.

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5 http://www.co2science.org/articles/V14/N6/B1.php.

Jaeger and Egelkraut (2011)[6] note renewable energy promotion, and especially that of biofuels, "has become a policy priority in many countries," but they remark "only recently has attention been drawn to some of the effects of biofuels on food prices, energy use, land-use change and carbon emissions." Thus, in an effort to "illuminate this information in ways that will inform good policy decisions," they proceed to examine biofuels from an economic perspective that "evaluates the merits of promoting biofuel production in the context of the policies' multiple objectives, life-cycle implications, pecuniary externalities, and other unintended consequences." And they do this by seeking answers to two key questions: (1) "How do the costs of biofuels compare to other options?" and (2) "Can biofuels be made available on a large enough scale to make significant progress toward those goals?"

When all is said and done, the two academics from Oregon State University's Department of Agricultural and Resource Economics state their analysis "raises doubts about biofuels in relation to the specific objectives for which they have been promoted," while noting "as a means of reducing fossil fuel use and greenhouse gas emissions, domestic production of biofuels in the United States is found to be 14-31 times as costly as alternatives like a gas tax increase or promoting energy efficiency improvements." In addition, they find "the scale of biofuels' potential contribution toward U.S. energy and climate policy goals is extremely small," stating the contributions of the mandates of the Energy Independence and Security Act of 2007 to the underlying goals of reduced fossil fuel use and reduced greenhouse gas emissions "are negligible."

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But the "most striking result," as they continue "may be the lack of evidence that biofuel policies can be expected to achieve significant reductions in greenhouse gas emissions, and that they may actually increase emissions." Summing things up, therefore, they conclude "judged on the basis of reducing fossil fuel use and greenhouse gas emissions," their results suggest U.S. biofuel policies "have been ineffective and highly costly, producing negligible reductions in fossil fuel use and significant increases, rather than decreases, in greenhouse gas emissions."

Diffenbaugh *et al*. (2012)[7] analyzed the response of U.S. corn markets to climate volatility under various alternative energy futures, one of which envisions "a binding renewable fuels standard for corn ethanol and capacity constraints on ethanol absorption." Although this scenario was initially viewed as a strong positive element of both agricultural and environmental policy, the four U.S. researchers found a binding mandate of this nature likely "enhances the sensitivity to

6 http://www.co2science.org/articles/V15/N21/EDIT.php.

7 http://www.co2science.org/articles/V15/N48/EDIT.php.

climate change by more than 50%," with the result that it could well "cause U.S. corn price volatility to increase by more than 50% in response to historical supply shocks in the domestic market," citing Hertel and Beckman (2011).

The underlying phenomenon responsible for this unwanted consequence is the fact, as Diffenbaugh *et al*. describe it, that a biofuel mandate will "amplify the price response to yield volatility by promoting market inelasticity." And they thus conclude such policy decisions "could substantially exacerbate the impacts of climate change, even for the relatively modest levels of global warming that [they believe] are likely to occur over the near-term decades."

As for what would happen if the risk-laden biofuel mandate were eliminated, Diffenbaugh *et al*. write "in the context of the 2020 economy and low oil prices, elimination of the biofuels mandate reduces corn price volatility from 41 to 32% in the historic [past] climate, whereas elimination of the mandate reduces price volatility from 200 to 109% in the future-climate/low-oil-price scenario." And they thus conclude some of the policy decisions the United States might make "could substantially exacerbate the impacts of climate change, even for the relatively modest levels of global warming that are likely to occur over the near-term decades."

Given the above, it would appear that the dream of growing the fuel required to keep the engines of *industry* humming -- as well as the engines that enable many of our leisure pursuits -- is simply too good to be true.

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