The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Ethanol and the Environment

Posted by Robert Rapier on September 4, 2007 - 10:06am
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As I continue to work on an Ethanol FAQ, I again wanted to solicit feedback from readers on the following question:

What about the environmental benefits of using ethanol as fuel?

The feedback I received on the previous posting on ethanol use and foreign oil displacement was very valuable in helping me to identify poorly communicated points, and make some key edits. I am hoping for the same kind of feedback on the present offering. I would also ask readers to take a look at the questions I have tackled in the FAQ, and let me know if there are glaring omissions, errors, typos, or items requiring additional clarification. I will continue to post some portions of the FAQ here for feedback, with the intent of posting a finished product within a month or so. And although it seems like all I have been posting on lately is ethanol, I don't expect that trend to continue following completion of the FAQ.

There are environmental benefits, as well as negative environmental consequences from using ethanol as fuel. If the ethanol is produced from industrial corn farms, more negative environmental consequences can be added.

Because of ethanol's marginal energy balance, there is a marginal reduction in greenhouse gas emissions per distance driven. Researchers have also found that ethanol produces less carbon monoxide when it is burned in an internal combustion engine.

On the other hand, ethanol raises the vapor pressure when blended with gasoline, which causes an increase in smog. In an August 1, 2007 article in the Houston Chronicle (now archived, but available at the following link):

Five questions with Cal Hodge

> Q: We're already using more ethanol in our fuel now, because of the outcry over the fuel component methyl tertiary butyl ether or MTBE and its propensity to foul groundwater. You had warned that replacing MTBE with ethanol could hamper efforts in cities like Houston to improve air quality because of these problems with volatile organic compounds and nitrogen oxides. So has that actually happened?
>
> A: Yes, it has happened. Los Angeles is the cleanest example. They began switching from MTBE to ethanol in 2001. But when they made their major switch in 2003, there was a significant decrease in air quality. They basically stopped making progress toward attainment on EPA's ozone standards when they switched to ethanol. When using

> MTBE, with the cars getting cleaner each year, coupled with a very clean fuel, Los Angeles was on a straight-line path toward attaining EPA's air standards by about 2002 or 2003. Now that they have switched to ethanol, the trend line indicates nonattainment for many years to come.

A 2007 research paper by Stanford University professor Mark Jacobson echoes that claim:

Effects of Ethanol (E85) Versus Gasoline Vehicles on Cancer and Mortality in the United States

In this paper, Professor Jacobson studied the potential impact to air quality as more E85 vehicles hit the roads, and he concluded:

> "In sum, due to its similar cancer risk but enhanced ozone health risk in the base emission case, a future fleet of E85 may cause a greater health risk than gasoline. However, because of the uncertainty in future emission regulations, E85 can only be concluded with confidence to cause at least as much damage as future gasoline vehicles.
>
> Because both gasoline and E85 emission controls are likely to improve, it is unclear whether one could provide significantly more emission reduction than the other. In the case of E85, unburned ethanol emissions may provide a regional and global source of acetaldehyde larger than that of direct emissions."

In addition to the mixed environmental impact of directly burning ethanol as fuel, industrial corn farming has significant negative environmental impacts. From a 2006 paper that evaluated ethanol and biodiesel:

Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels

> Both corn and soybean production have negative environmental impacts through movement of agrichemicals, especially nitrogen (N), phosphorus (P), and pesticides from farms to other habitats and aquifers. Agricultural N and P are transported by leaching and surface flow to surface, ground, and coastal waters causing eutrophication, loss of biodiversity, and elevated nitrate and nitrite in drinking-water wells. Pesticides can move by similar processes.
>
> The markedly greater releases of N, P, and pesticides from corn, per unit of energy gain, have substantial environmental consequences, including being a major source of the N inputs leading to the "dead zone" in the Gulf of Mexico and to nitrate, nitrite, and pesticide residues in well water. Moreover, pesticides used in corn production tend to be more environmentally harmful and persistent than those used to grow soybeans.

Two additional factors not discussed in the article are 1). Industrial corn farming depletes the topsoil, putting future generations at risk:

Peak Soil: Why cellulosic ethanol, biofuels are unsustainable and a threat to America

> Row crops such as corn and soy cause 50 times more soil erosion than sod crops [e.g., hay] or more, because the soil between the rows can wash or blow away. If corn is planted with last year's corn stalks left on the ground (no-till), erosion is less of a problem, but only about 20% of corn is grown no-till. Soy is usually grown no-till, but insignificant residues to harvest for fuel.

2). Corn farming and subsequent conversion to ethanol consume enormous amounts of fresh water:

Experts Differ About Ethanol-Water Usage

In this article, David Pimentel is the pessimistic expert who claims that when you add in the water required to grow the corn, it takes 1,700 gallons of water per gallon of ethanol produced. The "optimist" in the article, Derrel Martin, an irrigation and water resources engineer, said:

> Martin said the question of whether increased corn production and the irrigation it requires will overburden the state's water supply is an important one that does not yet have a clear answer.

Additional research has been reported by two Colorado researchers:

Biofuels: The Water Problem

> In late June, two Colorado scientists, Jan F. Kreider, an engineering professor at the University of Colorado, and Peter S. Curtiss, a Boulder-based engineering consultant, presented their peer-reviewed report, “Comprehensive Evaluation of Impacts from Potential, Future Automotive Fuel Replacements” at a conference sponsored by the American Society of Mechanical Engineers. The two found that producing one gallon of corn ethanol requires the consumption of 170 gallons of water. That figure includes the amount needed for all irrigation and distillation. For comparison, the two scientists estimated that each gallon of gasoline requires just 5 gallons of water. If Kreider and Curtiss are right, the 5 billion gallons of corn ethanol produced in America in 2006 required more water than production of the 140 billion gallons of gasoline the U.S. consumed that year.

Ethanol proponents have largely downplayed the negative environmental impacts of increased ethanol production, while emphasizing the positive impacts. But by ignoring the negatives, all of us, and future generations, are being put at risk.

Personal Note

Some of you may have noticed that I haven't been contributing much lately, nor posting with much frequency on my blog. I explained the reasons for this in a recent blog posting, but I just want to reiterate the point here. In an effort to more efficiently allocate my time, I am limiting my writing efforts. It had gotten to the point that I was literally working 45 hours a week at my

regular job, 45 hours a week on my blog, and my family was wondering why I wasn't doing more things with them.

I had considered the idea of just stopping cold turkey, but I believe the issues that we discuss and debate are of paramount importance. But, so are the other things in my life. So, I have come to a compromise solution. In order to eliminate the things that consume most of my time, I have essentially stopped participating in the comments sections (here and on my blog), I have taken my e-mail address offline, and I am limiting myself to writing in the early morning when I usually have some time before the family wakes up. What I have told them is that I intend to keep writing, albeit greatly scaled back. They are very supportive of what I am trying to accomplish (in fact, my 13-year old daughter told me yesterday that she wants to learn to be more environmentally responsible). My intent is for my writing to be transparent to my family and my employer. If I can't manage that, I will have to quit altogether. But I will manage it.