

Somebody's been smokin' switchgrass

INPUT-OUTPUT ANALYSIS SHOWS THAT MORE ENERGY FROM FOSSIL FUELS IS SPENT IN PRODUCING ETHANOL THAN CAN BE EXTRACTED FROM IT

I am intrigued by the recent endorsement of ethanol as a vehicle fuel, both in the recent U.S. State of the Union address, and by General Motor's promotion of its E85 vehicles. I have been aware of the concept for quite some time, and like others, believe that it takes more energy to produce ethanol than it contains.

It does not take very long to realize that there are two sides to this discussion and that they have been going at each other in a variety of public and technical forums. On one side you have the corn industry companies and their associations along with the U.S. Department of Agriculture, while on the other, a host of academic and research professionals.

There were a series of papers and reports in the 1999-2001 timeframe, followed by a 2003 analysis by David Pimentel, a Cornell university professor, in which he declared ethanol produced from corn to be an "unsustainable subsidized food burning."

This did not sit well with the corn industry or its advocates. No surprise here!

The industry responded with a series of critical analyses of its own, declaring that Pimentel's work was outdated, did not properly account for improvements in crop yield or process efficiencies, and included energy consumed by processes beyond the boundaries of normal analyses. Their claims played to the national desire to reduce oil dependency, embrace renewable alternatives and the use of "readily available coal and natural gas." They dismiss the input-output analyses and their authors as "BTU counters."

I too am an avowed "BTU counter," and considering entering a 12-step program to cure my own addiction.

In response, Pimentel and Tad Patzek, a Berkeley professor, revised their work in 2005, updating their original assumptions on agricultural yields and process efficiencies, but they did not alter their conclusions [1]. The paper is challenging to read, but conclusive in its assessment:

- Ethanol production from corn grain requires 29% more fossil energy to produce than is contained in the ethanol fuel

- Ethanol production from switchgrass requires 50% more fossil energy to produce than is contained in the ethanol fuel

Factoids influencing these negative outcomes:

- The fermentation process limits ethanol concentrations to 20% ethanol because the yeast cannot survive at higher concentrations

- Fractional distillation of this mixture yields a difficult-to-separate 96% ethanol, 4% water azeotrope

- 99.5% purity is required for blending E85, requiring further and more complex dehydration schemes involving intermediate compounds

- 1 liter of ethanol produces 13 liters of wastewater

- 30% of the energy input to grow corn is for natural gas-derived nitrogen fertilizer

- Corn production uses more nitrogen fertilizer than any crop produced and is a major contributor to groundwater and river water pollution

- Natural gas accounts for 90% of the fertilizer cost

- A reported 22% of the fertilizer capacity in the U.S. has been shut down and 50% of the nitrogen fertilizer is now imported

- Corn and soy crops cause topsoil loss that is 10 times the sustained rate

- Recovering corn stalks as it is called increases this by another factor of 10

Since natural gas is no longer considered "readily available" or affordable, the industry focus is now turning its emphasis toward the use of coal as its energy source and the feedstock for fertilizer, and the ethanol economics are now much more dependent on "co-products."

The theory on co-products is that we would be doing this anyway, so only the incremental costs need be included in the analysis. Ethanol is also "supported at the pump" through a variety of subsidies that mostly benefit the fuel producers, not the farmers.

We do not have a limitless supply of coal. We all talk about a 250-year supply, but this is at current consumption levels. This could easily be reduced to a 50-year supply if we implemented all the ideas

based upon the use of "inexpensive" coal.

I feel like we are running side-to-side on the Titanic! I don't think we want to turn coal into subsidized ethanol fuel. Rather than to pursue what seems to be special interests driven by the moment, we need to build fuel feedstock flexibility into our strategy. This is why the U.S. needs a real energy policy, divorced from short-term commercial interests and truly focused on long-term energy security and supply.

The various gasification and liquefaction type processes (p. 8) seem to offer this ability, and at the same time, seem to be consistent with the technologies currently under development as part of the clean coal efforts.

I think we can all agree that security, energy and environment are the critical issues facing us today, but we need to be pragmatic in our analyses and conclusions. The E85 seems to be driven more by special interest than science, whether derived from corn or switchgrass. ■

PS: The so-called Cape Town Convention has just become effective. This 10-year effort by the Aviation Working Group and led by archrivals Boeing and Airbus makes it easier for creditors to seize airplanes from deadbeat carriers. I guess that legacy carriers worldwide will now feel the pressure of start-up competition on their routes (See column in p. 40, Nov./Dec.).

Reference

[1] *Natural Resources Research*, Vol. 14, No. 1, March 2005

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