

White Paper

A clean technology white paper from Brodeur Partners and Beaupre

Biofuels' future growing like weed, algae and corn

by Mike McGrail

Every renewable energy source attracts skepticism, but biofuels have had a particularly rough ride over the last few years. As U.S. and European policymakers have pushed higher biofuel production as a renewable alternative to imported fossil fuels, environmental activists and segments of the scientific community have raised a steady stream of objections to the point where this ostensibly “green” fuel source is seen as an environmental enemy.

In most cases, an industry getting batted around in the press would be considered just another day at the office. But negative perceptions about today’s biofuels could delay development of renewable and environmentally sound biofuels, creating serious implications for the world’s energy future. Next generation biofuels are a credible and critical part of the future fuel consumption equation, but they will require massive investments in research and infrastructure. This won’t happen unless the industry can turn the tide of public opinion back in its favor.

Most of the biofuel industry’s image problems come from ethanol, the best known and most widely used biofuel. A 2007 report in the respected journal *Science* cast doubt on biofuels’ practicality. The article described findings from two academic researchers who confirmed that ethanol production consumes more energy than it delivers, while causing greater soil erosion, water and air pollution if production expands. That encouraged biofuel critics to characterize ethanol as a government-subsidized giveaway without the benefits to match its hype.

“Expansion of the corn ethanol industry will lead to more water and air pollution and soil erosion of America’s farm belt, while failing to significantly offset fossil fuel use or combat global warming,” said Scott Cullen, senior policy advisor for the [Network for New Energy Choices](http://www.newenergychoices.org/index.php?page=home&sd=df) (<http://www.newenergychoices.org/index.php?page=home&sd=df>).

Wenonah Hauter, executive director of the advocacy group Food & Water Watch, took an even harsher view: “In the long run, family farmers and the environment will be losers, while

agribusiness, whose political contributions are fueling the ethanol frenzy, will become the winners.”

An even deeper cut came when world hunger advocates and political figures started connecting the rise in biofuel production with food shortages in developing nations. *Foreign Affairs* magazine published an article by University of Minnesota economics and food policy scholars C. Ford Runge and Benjamin Senhauer warning about ethanol production’s effect on food prices. The growing demand for ethanol, they said, inflates the prices of edible crops beyond many peoples’ reach in the developing world.

“(Higher prices) might sound like nirvana to corn producers, but it is hardly that for consumers, especially in poor developing countries, who will be hit with a double shock if both food prices and oil prices stay high,” they wrote. “The World Bank has estimated that in 2001, 2.7 billion people in the world were living on the equivalent of less than \$2 a day; to them, even marginal increases in the cost of staple grains could be devastating. Filling the 25-gallon tank of an SUV with pure ethanol requires over 450 pounds of corn – which contains enough calories to feed one person for a year.”

Biofuels advocates have disputed the charge with facts of their own, pointing out that oil prices drive up food costs by raising fertilizer and transportation costs. They also maintain that war and political corruption cause much of the hunger in the developing world. This may be an effective response at the tactical level, but it’s also defensive. There is a better story to tell in biofuels, and advocates have to start telling it.

There is a large body of opinion – also backed by facts – that biofuels are an essential part of the future fuel mix, just as they have been since Henry Ford first made Model Ts that ran on an ethanol-gasoline mix. Even the *Science* article that criticized today’s biofuels said tomorrow’s biofuels deserve serious consideration, according to blogger and WorldWatch Institute President Christopher Flavin. “As one of the *Science* studies concluded,” Flavin wrote for worldchanging.com in Feb. 2008, “biofuels made from waste biomass or from biomass grown on abandoned agricultural lands planted with perennials incur little or no carbon debt and offer immediate and sustained greenhouse gas advantages.”

This new generation of biofuels is still largely in the laboratory, however. Venture capitalist Chris Martin and biofuels consultant Sam Cockerill suggest they might not make it out of the laboratory if political and economic support for biofuels dries up. New fuel development needs investments in technology, research and infrastructure. Without government and investor support, they’re not

going to get it. In their May 2008 article [“Are biofuels sustainable? The EU perspective.”](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2390541) (<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2390541>) the authors acknowledge first-generation biofuels’ shortcomings, but describe them as a necessary step to a better class of biofuels:

Investment (in new biofuels) depends on the existence of first-generation biofuels, which in the US means ethanol. With an annual output approaching 25 billion liters’, the US has overtaken Brazil as the world’s largest bioethanol producer, and output is expected to double by 2020. The US ethanol industry receives generous state support, and is based on corn feedstock using first-generation technology that is arguably not much better for the environment than burning the oil it displaces. Yet this industry has created an investment climate that has accelerated second-generation technology development. First-generation ethanol plants provide a valuable market for incremental technology in the form of better feedstock varieties, enzymes, microbes and other process enhancements. They stimulate the development of infrastructure: storage facilities, distribution networks and flex-fuel vehicles necessary for future bioethanol consumption growth. They also create the experience and know-how that venture capital investors look for in start-up management teams.

Second-generation biofuels are already attracting interest from investors and credibility from the technical community. A 2007 study funded by U.S. Department of Agriculture’s Agricultural Research Services at the University of Nebraska found that “cellulosic ethanol” made from switchgrass produced 540 percent more renewable energy than non-renewable energy consumer. Switchgrass is a non-food crop that grows just about anywhere, which would reduce the need to develop more acreage for agriculture. The U.S. Department of Energy and multinational petroleum company Royal Dutch Shell recently invested in two cellulosic ethanol ventures, Cleantech Group writer David Erlich reported in a July article. Biofuel researchers are also studying ways to make ethanol from farming byproducts, such as rice hulls and corncobs. That would make existing agricultural acreage do double duty with no additional cultivation.

Development of technology that produces ethanol from algae is attracting even greater attention from investors, ranging from VCs like Polaris Ventures – whose GreenFuel Technologies startup is already building its first algae-to-biofuel plant in Europe – to the U.S. Defense Department to Microsoft founder Bill Gates. While other biofuel stocks are slow growers with a limited, seasonal window for harvest, algae can double in volume overnight and can be harvested day after day. Algae also eats CO₂ and produces oxygen, and its oil content is 50 percent to 70 percent, where other biofuel plant materials are in the 20 percent oil range.

There is a core to all these stories the biofuels industry needs to flog mercilessly: biofuels mean more than ethanol made from food crops. Yes, corn- and sugar-based ethanol have played a significant role in the world economy for decades, and will continue to do so. But in their present

incarnation, they can't grow into a larger factor in the long-term fuel consumption equation. Their energy yield simply doesn't outweigh their environmental impact. As they mature and improve, however, first-generation biofuels will usher in second generation of biofuels with high energy yield, a small environmental footprint, and, most important, the public's confidence.
